REVIEW OF THE SPACE PROGRAM

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HEARINGS

BEFORE THE

COMMITTEE ON SCIENCE AND ASTRONAUTICS U.S. HOUSE OF REPRESENTATIVES

EIGHTY-SIXTH CONGRESS

SECOND SESSION

FEBRUARY 23, 24, AND MARCH 7, 1960

[No. 3]

PART 3

Printed for the use of the Committee on Science and Astronautics

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REVIEW OF THE SPACE PROGRAM

TUESDAY, FEBRUARY 23, 1960

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C.

The committee met at 10 a.m., Hon. Overton Brooks (chairman) presiding.

The CHAIRMAN. The committee will please come to order.

This morning I might say to the members of the committee that we are pleased to have our newest member, Mr. Tom Morris of New Mexico, who has been selected to take the place on this committee and succeed our able colleague, Mr. Hall. So we welcome you this morning. We have a lot of work for you and all the members of the committee and hope you have a lot of time to put in and a lot of energy to put into the affairs of this committee.

If I were from California or Florida, which I am not, I would say this is the fastest growing committee in the Congress. But I still say it is a good committee and we are happy to have you.

Mr. MORRIS. Will the chairman yield?

The CHAIRMAN. Yes.

Mr. MORRIS. Mr. Chairman, I just want to say it is a real pleasure and an honor to be assigned to this committee and to be associated with the gentlemen who have worked so hard on this very important question that this committee has jurisdiction over.

It is a real pleasure for me to be here.

The CHAIRMAN. Thank you, Mr. Morris. The gentleman who just came in there and to your right is Mr. Roush. Well, we are happy to have you.

As we near the end of the general posture hearings on space and missiles, we are able to record that the committee has heard from most of the top officials, both civilian and in uniform, who carry responsibility for national progress in these fields. This has been useful to the committee for the report it will make to the Congress, in due course, and we believe it has been useful to the American public, with the help of the press representatives who have covered these hearings, and they have been unusually faithful in that respect.

This morning we are holding a session I view as an important addition to our consideration of these vital problems. The committee has invited the major technical societies and other groups concerned with space and missiles to present their views for the record. We hope at an appropriate time late to hear from industry as well as to round out these hearings in full.

The societies which are represented here today in combination have tens of thousands of members, resident in all the States of the Union.

Their members include close to 100 percent of all the technical talent in the Nation of those concerned with the space effort. Therefore, the views they are going to present to use deserve to be listened to with profound respect by the members of the committee.

My thought is that we will ask each witness to give an oral statement about 10 minutes in length, and to file any longer written statement for inclusion in the record. After this, the members of the committee may ask them questions, as a panel.

I say that because we do have Congress meeting at noon and we have our subcommittees, three subcommittees ready to report. We are going to take those reports up Thursday. We hope by that time that all four will be ready to report to the full committee. We will take those up Thursday. We will look them over in connection with the bill that we are writing.

So tomorrow we will meet at 9:30 in the morning to hear one additional witness who was invited for our posture hearings and who could only be here tomorrow morning. We are meeting early so as to give the morning to the subcommittees to finish up their work.

Mr. MILLER. Subcommittee No. 1, Mr. Chairman, must have an executive meeting. It finished all of its hearings and is ready to mark up the bill.

The CHAIRMAN. You can do that this afternoon or tomorrow. It will be all right.

Mr. MILLER. We have a meeting set for this afternoon at 2 o'clock in my office.

The CHAIRMAN. I want to commend the subcommittees for diligence. They have really gone to work earnestly, sincerely, and vigorously. As I just mentioned, three of them are about ready to report, and Mr. Sisk's subcommittee, I am sure, will be ready very soon thereafter.

Mr. FULTON. Mr. Chairman.

The CHAIRMAN. Mr. Fulton.

Mr. FULTON. May I say we are glad to have the societies represented here, but they are better than I expected. If, as the chairman said, they represent more than 100 percent of the technical people connected with the space program, they are doing very well.

The CHAIRMAN. I said close to 100 percent. [Laughter.]

Anyway, 100 percent is good enough.

Mr. FULTON. The other serious point I wanted to make, which is the reason I asked for the minute, I would like to ask Mr. Anfuso, and Mr. King, through the chairman of the committee, that the Science and Astronautics Committee ask the NASA people to come up with a statement of the use of scientific manpower in the agency; that is, whether they are adequately being used for scientific purposes; whether there might be a diversion of their use to management or to survey purposes; and whether there is any topheaviness in the executive end of the agency, so that there may be too many scientists or too many managers.

The CHAIRMAN. The Chair is going to rule that that is a subcommittee matter. Until the subcommittee reports, it will have to be handled by the subcommittee.

Mr. ANFUSO. This afternoon that will be taken up. I will discuss it with you later.

The CHAIRMAN. The first witness this morning is Dr. Howard S. Seifert, president of the American Rocket Society. His biography has been placed before each member. He is also a senior staff engineer of Space Technology Laboratories and is the editor of the outstanding book issued last year called "Space Technology." He will present the statement of the American Rocket Society.

Dr. Seifert, we are happy to have you this morning. If you will proceed for about 10 minutes orally, we will file your statement and be glad to have you.

[From "American Men of Science," vol. I]

BIOGRAPHY OF DR. HOWARD STANLEY SEIFERT

SEIFERT, DR. HOWARD STANLEY, 382 S. Grand Oaks Ave., Pasadena 10, Calif. Physics: Reynoldsville, Pa., Feb. 17, 11; m. 33; c.3. B.S. Carnegie Inst. Tech, 32, M.S. 34; fellow, Calif. Inst. Tech. 34–37, Ph.D (physics), 38. Teacher, high sch, Pa. 32–34; asst. prof. physics, Kalamazoo Col, 34–40; research physicist, Westinghouse Elec. & Mfg. Co, 40–42; asst. proj. engineer and later chief liquid rocket sect. jet propulsion lab, Calif. Inst. Tech, 42–46, chief applied physics div, 46–51, staff engineer, 51–54; mem. research staff, Ramo Wooldridge Co, 54–[1]. Lecturer, Carnegie Inst. Tech, 42; U.S. Army Air Force premeterol. sch, Pomona Col, 43; Calif. Inst. Tech, 45–48. Tech. specialist, rocket ord. to Mil. Attache, London, 44. Asn. Physics Teachers; Rocket Soc. (assoc. ed, 'Jour,' 51–54). Liquid rocket motor design; missile systems.

(The statement referred to is as follows:)

TEXT OF STATEMENT ON AMERICAN ROCKET SOCIETY VIEWS OF U.S. NATIONAL SPACE PROGRAM

Made by Dr. Howard S. Seifert, president, American Rocket Society, before the House Committee on Science and Astronautics, February 23, 1960

I. THE AMERICAN ROCKET SOCIETY

Founded 30 years ago, the American Rocket Society is a professional society of approximately 15,000 engineers and scientists organized in 53 sections throughout the Nation. Its objectives are to foster and encourage the development of those sciences which relate to travel through interplanetary space; i.e., astronautics.

The areas of interest of the society are indicated by the following grouping of its 22 technical committees:

A. Flight Dynamics and Control:
   1. Astrodynamics.
   2. Guidance and Navigation.
   3. Communications.
B. Vehicle Design and Operation:
   4. Missiles and Space Vehicles.
   5. Structures and Materials.
   6. Power Systems.
   7. Test Facilities and Support Equipment.
   8. Logistics and Operations.
   9. Instrumentation and Control.
C. Propulsion:
   10. Propellants and Combustion.
   11. Liquid Rockets.
   12. Solid Rockets.
   13. Nuclear Propulsion.
   14. Ion and Plasma Propulsion.
   15. Ramjets.
   16. Underwater Propulsion.

[1] Now Senior Staff Engineer, Space Technology Laboratories.

COMMITTEE NOTE.—Dr. Seifert is President of the American Rocket Society, 500 Fifth Ave., New York 36, N.Y.

D. Fundamental Science:
   17. Physics of Atmosphere and Space.
   18. Hypersonics.
   19. Magnetohydrodynamics.
E. General:
   20. Education.
   21. Human Factors and Bioastronautics.
   22. Space Law and Sociology.

The name of the official society magazine was Astronautics during the 13 years from 1932 to 1945, and was changed to "Journal of the American Rocket Society" for most of the ensuing 15 years. At present two magazines are published, an archive-type Journal of the American Rocket Society and a semitechnical monthly called Astronautics.

The objectives of the society are accomplished by publication of these journals and by the conduct of numerous general and specialized meetings as well as by a number of other activities. For example, in 1957, prior to Sputnik, the society tendered a resolution to the President, urging the acceleration of space research. During the year 1960, approximately 10 general and specialist meetings will be held in addition to nearly 400 local section meetings.

The officers of the society consist of a president, vice president, permanent secretariat, and a 15-man board of directors, among whom are numbered many prominent contributors to the field of astronautics. The officers and directors comprise seven research directors, five vice presidents, and five engineering professors, all from major corporations or universities. Several of these men have testified or will testify before this committee as individuals. The officers and directors with their titles and affiliations are listed below:

Dr. Howard S. Seifert, president, ARS, special assistant to the executive vice president: professional development; Space Technology Laboratories, Inc.; visiting professor of engineering, UCLA.
Dr. Harold W. Ritchey, vice president, ARS, vice president, Rocket Division, Thiokol Chemical Corp.
Mr. James J. Harford, executive secretary, American Rocket Society.
Mr. Irwin Hersey, director of publications, American Rocket Society.
Dr. Ali Bulent Cambel, professor and chairman, Gas Dynamics Laboratory, Northwestern University.
Mr. Richard B. Canright, chief, Research Section, Douglas Aircraft Co.
Mr. James R. Dempsey, vice president and manager, Convair-Astronautics.
Dr. Herbert Friedman, Superintendent, Atmosphere and Astro Division, U.S. Naval Research Laboratory.
Dr. Robert A. Gross, Physics Department, University of California (formerly, chief research engineer, Fairchild Engineering Corp.)
Mr. Samuel K. Hoffman, vice president and general manager, Rocketdyne, a division of North American Aviation, Inc.
Dr. A. K. Oppenheim, professor of aeronautical science, University of California.
Dr. William H. Pickering, director, Jet Propulsion Laboratory.
Dr. Simon Ramo, executive vice president, Thompson Ramo Wooldridge, Inc.
Mr. William L. Rogers, vice president, Azusa Operations, Aerojet-General Corp.
Lt. Col. David G. Simons, chief, Department of Bioastronautics, School of Aviation Medicine, U.S. Air Force.
Mr. John L. Sloop, Chief, Rocket Systems Branch, National Aeronautics and Space Administration.
Dr. Martin L. Summerfield, editor, ARS Journal, Department of Aeronautical Engineering, Princeton University.
Dr. Wernher von Braun, Director, Development Operations Division, Army Ballistic Missile Agency.
Dr. Maurice J. Zucrow, professor of gas turbines and jet propulsion, Purdue University.

The immediate past president of the American Rocket Society was Col. John P. Stapp, chief, Aero Medical Laboratory, Wright-Patterson Air Force Base; his predecessor was Mr. George P. Sutton, presently chief scientist of ARPA and formerly Hunsaker professor of aeronautics at Massachusetts Institute of Technology.

II. THE SOCIETY'S VIEWS

In response to a request by the House Committee on Science and Astronautics to the president of the American Rocket Society, the members of the American Rocket Society's board of directors (listed above) were polled for their views on the adequacy of America's current space program. Two members abstained. A summary of the views received was made. The president assumes the responsibility for making this summary, since there was insufficient time for it to be reviewed by the board prior to this hearing. While the summary is representative in the sense that it records the majority view in a given issue, it is important to note that a spectrum of opinion exists on some matters. In order to remain as objective as possible and to present the committee with a source of authoritative opinion, there is appended a selection of quotations, categorized by subject matter, from the statements of the board. Those desiring a more detailed sampling of opinion than the summary can give may refer to this appendix.

In general, the board of directors seems to feel that three aspects of America's space program need discussion and examination—its planning, its funding, and its technical goals. The following is a résumé of their views on these matters:

1. Planning

The members of the board of directors feel that the present planning for the American space program could be improved. Its weakness lies in the absence of a clearly defined national policy on space. One day space is regarded as the key to the Nation's survival, the next as an expensive gamble which is largely irrelevant to our national destinies. Achievements in space are considered to be a revealing index of a country's technology and hence its position in the world; but they are also deprecated as mere propaganda, valuable only for swaying the have-not nations. The planning and funding of space projects are affected critically by these oscillations of opinion, often in a damaging fashion.

We as a Nation should decide, first of all, how important we feel space to be, and then be prepared act upon the consequences of our decision.

The American Rocket Society would like to make its position clear in this matter. It believes that the exploration of space is and will be of central national importance, and that the welfare of this country depends in large part upon the extent to which it is willing to accept the challenge of this new frontier. It believes this attitude practical, not romantic, for it sees space technology as a fruitful area for research. Space technology requires the solution of new problems in metallurgy, physics, mathematics, information theory and communications, fabrication techniques, nuclear power, and much more. These are matters which the American Rocket Society directors feel should not be neglected.

Once we have decided that space is important we should set a series of long-range goals for ourselves. This is essential, for the space race is a costly one to enter as a competitor and only countries who plan wisely will win. We need to appreciate the fact that space age leadtimes are longer than those of the pre-Sputnik tank or jetplane. For example, if we envision interplanetary travel as part of our national capability in 25 years, a substantial amount of time should be devoted now to nuclear propulsion and recoverable boosters. If we take a long-range view we shall also see that education is a most important commodity, and thus begin now to set up scholarship programs. We might also set up national laboratories in conjunction with our leading universities so that we can utilize their resources and enhance the education of scientists. If we want to compete 25 years hence, these things should be done now.

Once we have defined our aims for the space program, we shall be able to establish a series of logical steps by which to achieve them. We shall also have a series of meaningful criteria for assigning priorities to programs, rather than day-to-day switches of opinion that are costly in money and development time. We shall have, in short, a unified development plan which will be an expression of national purpose. This step must be taken before an integrated research and development program is possible.

These recommendations do not necessarily imply reorganizing the administration of our space program. While a few members of the board feel that all space and military efforts should be gathered under a single officer of Cabinet rank, most seem to think our present administrative setup will be adequate if it is properly used. Reorganization can markedly reduce the effectiveness of

groups, and it is often as much as a year before a reorganized group regains its efficiency. We are too far behind as it is, they feel, to permit such delays. What we need is clearly defined goals, not reshuffling.

2. Funding

The area in which the lack of organized purpose is perhaps most clearly in evidence is funding. Like our planning, funding should be geared to a series of long-range purposes based on a realistic appraisal of our national resources. Yet too often it is a series of catch-as-catch-can policies. The board of directors feels that funding should be allocated for at least 5 years in advance, preferably longer. The funding for initial phases of a project should be firm, for latter periods flexible enough to account for possible developments.

Funding of this sort would give a continuity to the efforts of both planners and doers. As things presently stand, budgetary oscillations sometimes wreck technological effort. At great expense a group of experts is gathered, organized, made efficient by experience, and then, just as it is beginning to function productively, suddenly disbanded because of a budgetary cutback. We must prevent such situations. They waste time and money, and they can force some of our better men out of defense projects, where we urgently need them, into more stable occupations. We must fund, in short, in such a way as to permit the continued effort of experienced groups.

The board feels that funding has been conspicuously deficient in the field of basic research. More funds are badly needed in this area. Furthermore, a short-term funding structure is incongruous with the nature of fundamental research. The length of the funding should be determined by the nature of the project, not by arbitrary fiscal dates.

The board urges that unless we take a long-range view of these matters, the bill for the conquest of space will be unnecessarily high.

3. Technical goals

While the general feeling of the board is that we should explore as many aspects of space as possible, several projects were called out for special attention. First, emphasis should be given to those high-performance vehicles and powerplants which require 5- to 10-year leadtime and without which major exploratory work cannot be done. These include million-pound class recoverable boosters, medium scale rockets using new energetic propellants, nuclear rockets of 100,000 pounds thrust and up, and electrical propulsion rockets of the order of one-tenth pound thrust. The board suggests increased studies in bioastronautics, astronomy, astrophysics, metallurgy, and solid state physics. As a means of gathering data for these studies, they suggest an integrated orbital system consisting in part of satellites used as engineering laboratories. Such a system could include provision for global communications and weather prediction in addition to basic research. Several feel that a program to take instrumented vehicles near and to the Moon should be pursued. The vehicles would be used to study the moon, and determine the feasibility of its use as a base or station for interplanetary explorations.

Some members point out that military and political pressures are exerted by a country's technical and scientific achievements. They hold that we must not force an artificial separation between the scientific and military potential of space, and that we must be fully aware of possible military aspects of space if we are to assure ourselves of an opportunity to explore space peacefully.

Appendix

Quotations From the Letters and Telephone Conversations

The following quotations, listed under a series of representative topics, are taken from the letters and phone calls of the members of the board of directors.

The topics covered are:

Planning
Funding
Objectives of space program
Important research areas
Basic research
Military aspects of space
Education
Administration of space program

PLANNING

"Our present program of basic research in space science is operated on a 'catch-as-catch-can' basis. Scientists have been funded to produce all the various payload packages without preassignment of vehicles or dates. Because of the limited number of vehicles available, payloads have been integrated with groups of incompatible experiments in order to give everybody a chance. The end result, however, is never entirely satisfactory to any of the parties involved."

"We must recognize the need for a sound space science program apart from the need for propaganda 'spectaculars.' If the political need demands the spectacular achievement, we should evaluate the present Russian lead and not dissipate our efforts in the preparation of missions in which there is little chance of our being first."

"In contrast to the urgency being expressed in the booster program * * * there seems to be little emphasis on planning the missions. For example, plans have been discussed with respect to a soft lunar landing of an automated tractor-type laboratory, capable of performing a variety of experiments such as X-ray fluorescence analysis of the lunar surface, measurement of its radioactivity, and the taking and analysis of core samples. To my knowledge, no firm decisions have been taken to develop the payload in spite of the fact that several years of intensive effort are hardly adequate to perfect such instrumentation. It seems likely that we shall have the boosters but would have to wait for the payloads."

"I believe that one of the most desirable combinations of the 'spectacular' with highly scientific objectives is a space observatory to extend astronomy into the ultraviolet and X-ray wavelengths and long wavelength radio spectrum beyond the ionospheric cutoff. On the assumption that we can look forward to boosters capable of placing several-ton payloads in very high orbits by the middle 1960's, we barely have the time to perfect the necessary instrumentation for a space observatory even on a crash basis. Plans for ultimately instrumenting such an observatory have been tentatively formulated but it will require an intensive program, starting with rocket astronomy in its present primitive state and advancing through a series of developmental payloads and broad sky surveys in order to achieve the 'know-how' for the final package. For lack of adequate support and emphasis, these steps are progressing so slowly at this time that I see little hope of effecting the ultimate payload in time to match the vehicular development."

"It is suggested that 10-year programs should be established by both the military and the civilian space organizations. The first year's programs should be in considerable detail, with each succeeding year requiring less specific program targets. Also, duplicate approaches and backup programs should be permissible in the early, less expensive years."

"General approval should be expressed for the NASA 10-year program of space exploration, as recently announced in the press. However, NASA should be urged by Congress to make use of American private industry wherever possible to develop its overall vehicles and launching systems and stop trying to do it all in its own house."

"If we are going to think of interstellar travel, even in the far distant future, it is well to undertake some research programs now that will eventually lead to the possibility."

"It is highly desirable that any research program be planned in logical steps, so that the next generation may continue it without serious loss of time that could be attributed to initial misdirection or initial lack of foresight."

FUNDING

"The subject of funding should certainly be considered. A congressional plan of budgeting the space program on a 5-year basis with a firm 1-year program and planning for the additional 4 years would be highly desirable. This would allow a continuity and planning that would benefit both the doing and the funding organizations."

"With reference to the funding, in my opinion the problem is more in the incorrect handling than the money available. The structure of short-term contracts for fundamental research is essentially paradoxical. The funding of a research program on the basis of an artificial period of a fiscal year is basically untenable."

OBJECTIVES OF SPACE PROGRAM

"The objectives of the U.S. space program should be the exploration of space, its use, and exploitation of its resources for both civilian and military purposes."

"From the scientific viewpoint, the intermediate objectives would involve a thorough geodesian mapping of the Earth, the complete description of geomagnetic field, aurora, particle trapping, airglow, particle interaction, and ionospheric phenomena, and a more complete grasp of meteorology than available at present. The emphasis in the exploration of the planetary system would be in natural and life sciences, chemistry of interplanetary space, meteorites, cosmic rays, magnetohydrodynamic phenomena, as well as providing opportunities for tests of general field theory, relativity, etc."

"There are three major areas which the U.S. space program should include: These are:

"1. Integrated orbital system: The system should be controlled or coordinated by a single agency. It should include subsystems such as communications satellites, meteorological satellites, instrumented and manned research vehicles, and manned space research laboratories.

"Objectives:

"(*a*) Provide research capabilities for medicine and other basic sciences.

"(*b*) Provide common services such as communications and weather prediction.

"(*c*) Explore potential uses and benefits of orbital environments and applications of orbital operations.

"(*d*) Ascertain possible military exploitation of space.

"2. Lunar exploration. The program should include instrumented vehicles to and near the Moon, manned lunar circumnavigation, and manned landings.

"Objectives:

"(*a*) Provide basic research information about the Moon and its environment.

"(*b*) Determine desirability and feasibility of establishing manned lunar base and its functions.

"3. Planetary and interplanetary exploration. The program should include instrumented probes to and near planets, later instrumented landings, and manned planetary exploration if determined to be desirable.

"Objectives:

"(*a*) To provide basic information about other planets of the solar system and the environment of interplanetary space.

"(*b*) To determine desirability and feasibility of manned planetary exploration."

IMPORTANT RESEARCH AREAS

"The large chemical boosters of 1 million to 1,500,000 pound thrust should be continued with improvements incorporated as technology permits. Clustering of the engines should be considered to increase the overall thrust level available for ambitious missions."

"The high energy (LOX-hydrogen) engine field should be expanded to incorporate the presently planned 200,000 pound thrust engine size. A 3 year review of the high energy program should be made to determine if the requirement exists for the next larger engines, possible 500,000-pound thrust (LOX-hydrogen)."

"An immediate start should be made in the nuclear engine field. A thrust of 75,000- to 90,000-pound size (to fit present reactor design) would seem to be a first logical step. Such an engine should be ready for flight about 1965. A review of the nuclear program in about 3 years should be made to determine the feasibility and requirements for a larger thrust nuclear rocket engine."

"The electrical propulsion field could be enhanced by the initiation of a 0.1-pound thrust engine at this time. Such an engine could be ready for flight in 1964 to 1965. A review of the electrical propulsion progress should be made in 1962 to determine the requirements for a larger engine—probably of the 1- to 10-pound thrust size."

"Engineering design data are needed in order to exploit most economically and efficiently our new space frontier. Several engineering laboratories (initially unmanned, of course) should be put into space to gather the needed information."

"The experimental and development work leading to a nuclear rocket engine should be expedited, so that the only presently known type of high-thrust, high-specific impulse rocket powerplant can be available sooner, to economize on the total bill for space exploration. Concurrently with the increase of emphasis should come design and experimental studies leading to an engine of a thrust size ($\geqq$300K) useful for space exploration, together with initiation of design studies of the optimum (costwise) airframe into which this powerplant can be integrated."

"Serious studies should be stepped up in bioastronautics, a man's survival in space and on other planets. This might include research into closed ecological systems, food cycles, biological cycles, resynthesis, respiratory quotient, and use of algae."

"More research in the area of astronomy and astrophysics should be initiated."

BASIC RESEARCH

"We cannot recommend too strongly the need for more adequate funding in basic research, particularly in the materials areas of metallurgy and solid state. A higher level of basic research support is also definitely called for in those types of space science based on ground level observations. In this latter category our national radio astronomy effort is sadly neglected."

"Basic research should be taken out of the hands of the Department of Defense and the AEC (the two Government agencies that spend most of the Federal funds in this area) and put into the hands of a civilian agency staffed by professional scientists, and the amount of Federal support in this field should be sharply increased."

"Basic research in the space field should be provided with long-range funding rather than the present annual budget. The length of the funding should be dependent upon the nature of the project."

"More Government support should be given to long-range fundamental research so that the researchers can serenely concentrate on their work rather than coming out with inconsequential results to satisfy quarterly or yearly nontechnical contractual requirements. Fundamental research studies should not be governed by development and production divisions."

"We should have a number of national laboratories for basic studies. Whenever possible these laboratories should be located in close proximity to universities to utilize buried talent to a maximum and to maximize the education of many more scientists."

MILITARY ASPECTS OF SPACE

"Ballistic missiles now are needed to complement long-range manned bombers in an overall deterrent force. Similarly, military space vehicles will be needed to complement the ballistic missile force. These military space vehciles will be for reconnaissance, early warning, communications, weather, and navigation purposes."

"The military must support and is supporting President Eisenhower's policy that space is for peace. But, in order to ensure that it is only used for peace by all who might enter it, we have to explore space thoroughly and determine the military potential. Once we learn what is possible militarily, we will have to exploit this potential and provide in space the deterrent force that is necessary there. In order to determine the military potential, many scientific experiments will have to be conducted, but if we make only scientific explorations of space, then we take a big chance in falling behind militarily as I am sure the Russians will utilize anything that they can in a military way in order to achieve a military superiority."

"We may not know the nature of an effective military space force now, but when we do identify it and implement it, we will find that a strong deterrent space force is the best way to ensure 'Space is for Peace.' "

"It is not nearly so important at the present stage of international affairs to win the scientific race into space as to win the ICBM missile race and to win the overall race for retaliatory power. If the financial choice must be made between speeding up Saturn and, say, an airborne alert, actual civil defense, a reactivation of the B–70 program, or a missile speedup, then the latter projects should be voted. A year's delay in Saturn will not endanger the nation; an inadequate retaliatory power will."

"Military space systems offer hope for removing the H-bomb threat from civilian populations."

"The United States should not sign any pact agreeing only to the peaceful exploitation of space (compare use of the ocean, in peace and in war)."

EDUCATION

"One area that needs heroic measures is education. Another is the support of basic research. Proper education is costly and large amounts of Federal tax money will be required to do the job. This is especially true in the field of higher education."

ADMINISTRATION OF SPACE PROGRAM

"Combine the present military and civilian space programs under one central agency. Under a single civilian leader this agency should be charged with our space responsibilities and governed by a primarily technical group."

"The present industrial competitive bid system for Federal space projects is obsolete and should be abolished. Rather, a system (of which there have been several suggested) should be installed which permits the continued efforts of experienced, successful groups, without major influence of budget oscillations."

"It is more important to maintain the integrity of existing R. & D. laboratory groups than to establish new agencies. Every reorganization destroys the efficiency of the groups being reorganized for a period of at least a year and perhaps 2 years. The R. & D. competence and logistics experience of military laboratories ought to be coordinated with the operations of the civilian organizations to fully utilize all the facilities in the country and to make the fullest use of all the available trained manpower."

(Paraphrase of telephone conversation:) "I am not satisfied with the way NASA chooses its projects. I fear that too many nontechnical considerations enter its thinking. Moreover, they are inadequately funded to keep up with the Russian effort. The NASA administrators were told by the budget directors what dollars were available rather than asked what dollars were needed. I believe that 1 percent of the gross national income should go into the effort. There is some question whether the NASA organization is able to handle projects of this magnitude and 'think big,' as the military are accustomed to doing. I believe the NASA group are using military hardware and 'drying up' the available military program without being able to replenish it with an aggressive long-range, large-scale booster program."

(Paraphrase of telephone conversation:) "We should emphasize the urgency of a unified program, and not dissipate energy between competing agencies. It is too costly in dollars, men, and especially facilities, to spread our efforts between NASA and the Air Force. I do not, at this time, claim to have answers as to how to accomplish unification.

"Since this is a cold war and not a hot war, the space program should emphasize scientific and exploratory needs rather than military 'requirements.' This does not mean that ballistic missile programs should be neglected; in fact, the military would do well to concentrate on a really good ICBM.

"Military control of the entire space program might lead to an expensive satellite armament race, divert limited funds from a proper basic scientific program, and produce an impression of U.S. militarism on the world. I recommend civilian, presumably NASA, control and not yet another organizational structure over both NASA and the Air Force."

(Paraphrase of telephone conversation:) "I believe our primary need is to support the importance of the space program. This was stated very well by George Allen of the U.S. Information Service in a Time article a few weeks ago. This importance justifies a 50- to 100-percent higher budget than is now allotted, to go mainly toward items such as nuclear propulsion and manned space laboratories.

"We are too far committed to the present (NASA-Air Force) organization to change again. Let's give it a chance to work. I believe NASA should operate in the spirit of the old NACA and do more fundamental supporting research and less operational big booster development."

"Perhaps the major factor in determining the space program of this Nation is our military requirements. Man is headed now for exploration of space, and some of our future space programs can properly be labeled as nonmilitary or pure research. However, this research is very expensive. Meanwhile, the military requirements include heavy expenditures to provide the big boosters to get us into space, the complex electronics apparatus for guidance and control of and communication with spacecraft, and the facilities for launching, maintenance, and handling of data. It will shortly become clear, if it is not clear today, that the way to accomplish the most research and exploration for each dollar is to have close ties with the military."

"Wisdom must accompany imagination. Our chance for survival depends on making better choices than any potential enemy nation of all the possible things we can do.

"If we are tired of cheap predicting and promoting, we are tired also of the argument that we must do various things because the Russians might do them first. We want to choose to do what we think makes the most sense for us as a nation, and not be influenced to do other things in a misguided effort to accomplish the impossible; namely, to be first in everything that can be achieved in space. That would be the same as allowing the Soviet Union to determine our defense and research programs."

The American Rocket Society, 1930–60

The American Rocket Society is the largest professional society in the world devoted solely to the advancement of the field of astronautics and related sciences. ARS now numbers over 15,000 members, a growth of more than fivefold in 5 years, making it one of the most rapidly growing professional engineering organizations in the United States.

In accordance with the society's purpose to promote the field of astronautics, it has in its 30-year history been a leader in the effort to obtain for this country a superior space program. In two instances in particular ARS programs led directly to action by the Government in the space field.

In November 1954 the ARS Space Flight Committee, headed by Milton Rosen, presented a proposal to the National Science Foundation calling for sponsorship of a study of the utility of an unmanned Earth-satellite vehicle. This proposal was one of the factors which led to the announcement by President Eisenhower in July 1955, that the United States would launch a satellite in the course of the International Geophysical Year.

In October 1957 ARS submitted to President Eisenhower a full-scale report calling for immediate initiation of a long-term national space flight program to be administered by a new independent Government agency with broad powers in this area. The report, drawn up before the Sputnik I launching by the ARS Space Flight Committee, headed by Krafft A. Ehricke of Convair-Astronautics, and including many of this country's top astronautical engineers and scientists was one of the considerations which led to the establishment of the National Aeronautics and Space Administration.

The society, which is comprised of and dedicated to astronautical scientists and engineers, carries out its objectives principally through the dissemination of information in its two publications, Astronautics and ARS Journal, and through its technical meetings, numbering over 500 per year on both a local and national level.

PUBLICATIONS

Astronautics covers topics of broad interest to the field, written to keep the specialist in one area abreast of developments in other areas that affect his specialty. It also carries general news of the field including contract awards, personnel news, patents, and new product announcements.

ARS Journal is an archive publication covering in detail research and development work of particular interest to the specialist in such fields as astrodynamics, propellants, combustion, hypersonics, physics of space, liquid and solid rockets, and others. In the fall of 1959, ARS, under the sponsorship of the National Science Foundation, began publishing a quarterly supplement to ARS Journal of translations of articles on astronautics or related subjects appearing in Russian technical journals.

MEETINGS

The society holds two major meetings a year, the annual and semiannual meetings. At these two, all the astronautics disciplines are represented so that at one meeting, the scientist and engineer can hear not only of late developments in his particular area, but also acquaint himself with the state of the art of allied fields.

In addition to these two meetings, smaller specialist conferences are held which devote themselves to more exhaustive studies of specialized segments of astronautics.

Examples of current specialist conferences are:

January 28–29, 1960: Solid Propellant Rocket Research Conference, Princeton University, Princeton, N.J.

February 17–19, 1960: Ballistic Missile Defense Conference (secret), cosponsored by ARPA, College of William and Mary, Williamsburg, Va.

March 23–25, 1960: Ground Support Equipment Conference, Detroit, Mich.

April 6–8, 1960: Structural Design of Space Vehicles Conference, Santa Barbara, Calif.

Behind the program of these meetings and contributing to the quality of material carried by the two publications are 22 technical committees which solicit, screen, and program material for presentation. These technical committees, covering specialties from astrodynamics to underwater propulsion, are headed by scientists and engineers prominent in the specialty and supported by committee members also distinguished in the field, providing the highest quality panel for selecting material most appropriate for presentation to the membership.

AWARDS

The society makes seven awards annually to people who have distinguished themselves in various fields of astronautics. These awards are the Robert H. Goddard Memorial Award for outstanding work in liquid rockets, C. N. Hickman Award for outstanding work in solid rockets, G. Edward Pendray Award for outstanding contribution to the rocket and astronautical literature, ARS Astronautics Award for outstanding contribution to the advancement of space flight, James H. Wyld Memorial Award for outstanding application of rocket power, and the ARS Chrysler Corp. and Thiokol Chemical Corp. student awards, the former for undergraduate, the latter for graduate students.

SECTIONS AND STUDENT CHAPTERS

The nationwide membership is organized into 52 sections, which meet on the average of once a month. These meetings give members a chance to hear outstanding lecturers in their fields and to get together on a social basis to exchange views and ideas.

Similarly, the society has 46 student chapters formed at universities and colleges throughout the country which encourage engineering and science students to augment their work and to give them contact with professionals working in the field.

HISTORICAL BACKGROUND

Though most recognition has been given to the society in the post-Sputnik era, it was organized on April 4, 1930, by a group of 11 men and 1 woman, primarily science fiction writers, for the purpose of promoting interest in space flight. Of the original dozen only one man, Dr. G. Edward Pendray, is still a member of the society, but the organization spawned by this group has continued to grow.

The founders originally named the group the American Interplanetary Society but changed its name to the present one in 1934 because, as the editor of Astronautics explained at the time, "In the opinion of many members, adoption of the more conservative name, while in no way implying that we have abandoned the interplanetary idea, will attract able members repelled by the present name."

In June of 1930, the group printed its first publication, at first in mimeograph form, titled, the Bulletin, and subsequently retitled Astronautics, then the Journal of the American Rocket Society, Jet Propulsion and now ARS Journal. In August 1957, the society began publication of its second magazine, Astronautics.

In 1931, inspired by a trip by Dr. Pendray to Europe on which he talked with leading European scientists working with rockets, the society formed an experimental committee with Dr. Pendray as chairman. This group designed the first ARS rocket, consisting of two parallel cylindrical tanks of standard aluminum piping, each 5½ feet long and 2 inches in diameter. They were held at the top by a frame piece which supported the motor and its cooling jacket, turn-on valves that could be operated electrically from a distance, and a cone-shaped nose piece containing a parachute. At the rear of the rocket were large sheet-aluminum fixed vanes for guiding in vertical flight. The fuels were gasoline and liquid oxygen.

The rocket received its first burning test on November 12, 1932, on a farm near Stockton, N.J., and though it performed as desired it was accidently damaged in testing and therefore never flight tested.

A streamlined version of the rocket, dubbed ARS rocket No. 2, was shot in a field at Marine Park, Great Kills, Staten Island, N.Y. on May 14, 1933. It reached an altitude of about 250 feet, after firing about two seconds and was still going when a stuck valve caused the oxygen tank to explode. This firing was followed by two subsequent ones in September of 1934.

The society then began a series of proving stand tests, which though clogged with difficulties, resulted in the development by James Wyld of his regenerative motor which subsequently was the basis for the organization of Reaction Motors, Inc., in New Jersey in 1941.

Membership in the society during this period included mostly experimenters since there was no rocket profession to speak of. Dr. Robert H. Goddard, the father of American rocketry, is one of the few ARS members who could have been considered a working professional then since his New Mexico developments were being subsidized by the Guggenheim Foundation. Dr. Goddard was an ARS director in the early 1940's.

A 1946 roster lists only 120 members. At about this time, however, the society expanded nationwide when a number of engineers and scientists from Aerojet Engineering Co., the first western rocket enterprise, and from the Jet Propulsion Laboratory at California Tech., joined. From then on growth was much more rapid.

It is interesting to call attention to some of the ARS members in the early 1950's and contrast their responsibilities then with those of today:

	Responsibility in early 1950's	Responsibility in 1960
J. V. Charyk	Associate professor, Princeton University.	Under Secretary of the Air Force.
James R. Dempsey	Program manager MX-1593 (early name for Atlas).	Vice president, Convair-Astronautics.
Krafft Ehricke	Preliminary design engineer, Bell Aircraft.	Program manager, Centaur, Convair-Astronautics.
Richard W. Porter	Manager, Hermes project, General Electric Co.	Vice chairman, COSPAR.
George P. Sutton	Engineer, Aerojet Engineering Co	Chief Scientist, ARPA.
Wernher von Braun	Chief, Guided Missile Branch, Redstone Arsenal.	Director, Development Operations Division, ABMA.

INTERNATIONAL RELATIONS

ARS is the American voting member of the 21-nation International Astronautical Federation. The IAF meets each year for scientific and plenary sessions. Last year the meeting was held in London and was attended by some 500 scientists and engineers. More than half of the papers presented were by ARS members. A delegation from the House Committee on Science and Astronautics participated.

The 1960 IAF Congress will be held at the Royal Technical Institute in Stockholm, August 15–20. President of the IAF this year is Academician Leonid I. Sedov of the U.S.S.R. Col. John P. Stapp of ARS is one of the vice presidents. Two ARS members have held the IAF presidency: Frederick C. Durant III and Andrew G. Haley.

At the ARS 14th annual meting in Washington, November 16–20, 1950, Professor Sedov headed a five-man delegation from the U.S.S.R. which presented important new material on the U.S.S.R. sputnik and cosmic rocket orbits and

their findings. Abe Silverstein, Director of Space Sciences for NASA, was chairman of the session at which these papers were presented and described them as having "presented information which gave one an overall impression of the space program in the Soviet Union. This effort appears to show a carefully directed, intense program which is soundly based and is being carried out on a long-range basis. The Soviet scientists were friendly, cooperative, and were willing to exchange views and some ideas, and to answer most of the scientific questions which were presented to them. Further contacts of this nature are certainly valuable, as they improve communications between the scientific and technological communities of the U.S.S.R. and this country."

In August or September 1961, ARS is scheduled to be host to the IAF Congress in New York. The gathering is expected to bring some 500 space authorities from all over the world.

ARS YOUTH PROGRAM

Because of the high incidence of accidents involving amateur rocket experiments, the society issued last year a 76-page report analyzing the problem and is widely publicizing its conclusion that it is "unalterably opposed to amateur rocket experimentation with explosive propellants of any kind regardless of supervision."

The society's education committee, headed by Prof. Irving Michelson of Pennsylvania State University, is developing a positive program of study and nonhazardous experiments for would be space scientists in cooperation with such organizations as Civil Air Patrol, the Boy Scouts of America, and other qualified groups.

THE COMING YEARS

The society regards its mission in the 1960's particularly urgent for the engineers and scientists it serves, for the astronautics field and for the Nation.

Its responsibilities are summarized in these excerpts from the objectives which President Howard Seifert outlined to the ARS Board of Directors at its meeting on January 27, 1960, in New York:

To manifest leadership in improving the quality of professional communications media in the astronautics field.

To make a conscientious effort to create new media for communicating the significance of the achievements and potential of astronautics to the Nation at large.

STATEMENT OF DR. HOWARD S. SEIFERT, PRESIDENT, AMERICAN ROCKET SOCIETY; ACCOMPANIED BY DR. MARTIN SUMMERFIELD, EDITOR, ARS JOURNAL, MEMBER OF BOARD OF DIRECTORS; AND JAMES J. HARFORD, EXECUTIVE SECRETARY, AMERICAN ROCKET SOCIETY

Dr. SEIFERT. Thank you, Mr. Chairman. I would like briefly to identify the American Rocket Society. It was founded about 30 years ago. It has about 15,000 engineers and scientists as members and its objectives are to foster and develop those sciences that are related to interplanetary travel. This is defined in Webster as "astronautics."

I would like to point out the membership of the board of directors. We include among our 15 directors some names whom you may recognize: Dr. William Pickering of the Jet Propulsion Laboratory, Dr. Simon Ramo of the Thompson Ramo Wooldridge Corp., Dr. von Braun of ABMA, Mr. Jim Dempsey of Convair, and Mr. Samuel K. Hoffman of Rocketdyne, as well as Dr. Martin Summerfield who is professor at Princeton and editor of our ARS Journal.

The rest of the board is of a similar high caliber, but these gentlemen may be known to you.

I polled this group by wire and I have attempted to make a summary of their views. However, I must take the responsibility for

this summary since I did not have time to review it with them prior to the committee hearing.

The board seems to feel that there are three aspects of the space program that would bear discussion—the planning, the funding and the technical goals. Some of these goals are, in fact, being implemented.

First, the planning. The members of the board feel that the present planning has a weakness, in that there is not a clearly defined national policy. One day space is regarded as the key to the Nation's survival and the next day as an expensive gamble which is largely irrelevant to our national destiny. The planning and funding of space projects is affected critically by these oscillations of opinion, often in a damaging fashion. We feel then as a Nation we should decide how important we feel space to be.

The Rocket Society would like to make its position clear. It believes that the exploration of space is of central national importance and that the long-range welfare of the country depends on the extent to which we are willing to accept the challenge. It is a fruitful area for research, particularly in such subjects as physics, mathematics, and communications.

Once we have decided that space is important, we should set a series of long-range goals. For example, if we envisage interplanetary travel as part of our national capability in 25 years from now, a substantial amount of time should be devoted now to nuclear propulsion, recoverable boosters, and the like. Similarly, if we take a long-range view, we see that education is a very important commodity and we should begin now to set up such things as scholarship programs and national laboratories in conjunction with the leading universities.

Once the aims for the space program are defined, we shall be able to establish a series of logical steps by which to achieve them and have a series of criteria for assigning priorities to programs. In short, we will have a unified development plan.

These recommendations do not necessarily imply reorganizing the administration of the space program. Some members of the board felt that perhaps a single officer of Cabinet rank should have authority over these matters, but most seem to feel that the present administrative setup will be adequate and, in fact, that reorganization would markedly reduce the effectiveness of groups.

In other words, what we need is clearly defined goals and not reshuffling.

Item 2 for discussion is funding.

The board feels that the area where the lack of organized goals is most clearly in evidence is in the funding. It should be geared to a series of long-range purposes; and yet, too often, it has a somewhat catch-as-catch-can character. The board of directors feel that the funding should be allocated for at least 5 years in advance, and preferably longer, with the initial phases firm and later periods funded in a flexible manner to allow for developments.

This would assure continuity of effort. As things presently stand, budgetary oscillations sometimes wreck technological effort.

A group of experts is brought together and made efficient and then just as it begins to function, it is disbanded because of budgetary cutback. We must fund, in short, in such way as to permit the continued effort of an experienced group.

The board feels particularly strongly that the funding has been deficient in the field of basic research. A short-term funding structure is incompatible with the nature of basic research. The length of the funding should be determined by the nature of the project, not by arbitrary fiscal dates.

I might add that no comment on the quantity of funding is indicated here except that it should be continuous.

Finally, the technical goals—and this concludes my statement: The general feeling of the board is that while we should cover as many subjects as possible, there are certain projects they call out for special attention.

First, the emphasis to those high performance vehicles which require 5 to 10 years' leadtime and without which major exploratory work cannot be done, such as million-pound class recoverable boosters, medium-scale rockets with the new energetic propellants, nuclear rockets of 100,000-pound-thrust up, and electrical propulsion systems.

The board suggests that satelliteborne studies of such matters as astronomy, bioastronautics, and metallurgy be carried forth by means of an integrated system consisting of satellites used as engineering laboratories.

Such a system might also provide for global communications and weather prediction in addition to these engineering research programs.

Finally, some members point out that military and political pressures are often exerted by a country's technical and scientific achievements. Therefore, they hold that we must not force an artificial separation between the scientific and the military potential of space and that we must be fully aware of the possible military aspects of space if we are to assure ourselves of an opportunity to explore space peacefully.

This concludes my statement. There are attached to the formal statement a series of direct quotations from the members of the board for those who would like more detailed survey of opinion. Thank you.

The CHAIRMAN. Thank you very much, Dr. Seifert. We appreciate very much your statement.

Now, the second witness is Dr. George R. Arthur, president of the American Astronautical Society. His biography has been placed before each member of this committee. He is also systems projects engineer, Missile and Space Vehicle Department of the General Electric Co. He will present the statement of the American Astronautical Society.

(The biography follows:)

BIOGRAPHY OF DR. GEORGE R. ARTHUR

Dr. Arthur received his education at Yale University, graduating with high honors in 1948 with a bachelor of science degree. In 1949 he received his masters degree, and in 1952 a Ph. D. in mathematics and engineering. While at Yale he was a Thomas Edison fellow in 1949. From 1949 to 1952 he was an instructor in electrical engineering and a research fellow.

From 1952 to 1956 Dr. Arthur was employed by Sperry Gyroscope as a section head in charge of missile guidance systems and automatic pilots.

From 1956 to 1959 he was manager of design engineering at the RCA Airborne Systems Facility, specializing in television, infrared, and special missile systems. He recently joined the General Electric Missile and Space Vehicle Department and is associated with the advance space vehicle engineering operation.

Dr. Arthur is a consulting editor for Automatic Control magazine, a fellow of the American Association for the Advancement of Science, and president of the American Astronautical Society. He is a senior member of the IRE and a member of Tau Beta Pi and Sigma Xi. His articles have been published in the Journal of Applied Physics, the IRE Proceedings, the British IRE Journal, Television Engineering, and Automatic Control magazine.

The CHAIRMAN. Now, Dr. Arthur, Dr. Seifert, we are going to need all of you in front for the question. However, if you will proceed, Dr. Arthur, we would appreciate it.

STATEMENT OF DR. GEORGE R. ARTHUR, PRESIDENT, AMERICAN ASTRONAUTICAL SOCIETY, INC.

Dr. ARTHUR. Thank you, Mr. Chairman.

I should like to express my thanks to the chairman and to the committee members for inviting me here and giving me this opportunity to present the views of the society on this vital subject. I am here in my capacity as president of the American Astronautical Society and I am trying to present substantially the society's views, although it is somewhat difficult to keep personal reflections from creeping in and I shall attempt to identify them.

This statement has been prepared through discussions with the majority of our board members and with the board of directors of several of the regional sections of the society.

The best point of departure for this statement is to outline briefly the broad objectives of the American Astronautical Society and then to relate this position of the society to the space flight programs and philosophy in the United States today. More particularly, it will relate to some of the specific programs in space technology.

The American Astronautical Society is composed of scientists and engineers in the astronautical sciences. We are a national scientific organization dedicated to the advancement of the astronautical sciences. The society considers manned interplanetary space flight a logical progression from today's high performance research aircraft, guided missiles, and Earth-satellite operations.

I shall attempt to hit the high spots of four major areas: The present approach to the space program, public information programs, organization, and education.

How does this relate to the present situation? As noted above, the society believes that manned space flight and all it implies is a logical progression from today's technology. We believe that this is a natural evolution of mankind and that mankind can benefit greatly by the step into space. These benefits have been included and described in detail by other speakers before this committee and include such things as communications satellites, navigation satellites, meteorological satellites, and similar items. Are we doing all we can to reap these benefits?

As far as the U.S. program is concerned, the following comments can be made.

The field appears to divide into two major areas: (1) Scientific exploration, and (2) applications of systems.

Sputnik, Vanguard, the Explorers all have been in the first category. The manned systems cover both areas.

It appears that the U.S. program in the area of exploration by Earth-satellite operations is reasonably well in hand. This scientific exploration program has dealt largely with unmanned vehicles.

The one area of exploration where a more rapid rate of development appears warranted and very useful as an aid to applications is the planetary probe.

We now see in retrospect that the program for manned space flight probably got off to a late start, and is now proceeding at only a modest pace. Although some advance planning is in progress at the present time in the manned satellite field, it is felt that the lack of strong support for a substantial follow-in program to Project Mercury is a definite gap in our present space program.

It must be noted that the sixties will be an era of technology and engineering and this is the area where our path is difficult. By technology and engineering, I mean the process of physically realizing in equipment many of the concepts and approaches that have been known for years. These concepts have received much study effort in the past few years and are now on the verge of fruition due to our great strides in propulsion and other technologies which have occurred since World War II.

In essence what I am trying to say is that this is the decade of reducing to practice the goals proven feasible in the past. This is where the U.S.S.R. appears to have stolen a march on us.

In the applications area, the U.S.S.R. has no known work but much is suspected. They have an extremely high capability due to the size of their boosters and to the state of their technology in instrumentation and guidance as demonstrated by their lunar shots.

The United States has several programs in the applications area but there is some question whether our work in this field has clearly established long-term goals.

Some applications programs seem to sit on a single approach and refuse to budge until forced. Others proceed in sort of a herky-jerky fashion by jumping to another approach too quickly.

To summarize this point, it appears the U.S. program is a conservative one as there are many areas where we could be bolder, specifically in application areas such as the meteorological satellites, communications satellites, and navigation satellites. We must remember that programs of this type have tremendous potential and we would be in favor of accelerating this type of program independently of any Russian accomplishments.

In the area of public information, it is respectfully suggested that Congress seriously consider some kind of formal program in the space field for the following reasons. There is a tendency today through the medium of the Sunday supplements and other information media such as TV to engage in what might be called space charletanism. The public is constantly besieged by all sorts of predictions, stories, pictures, artists' conceptions, and the like about space flight in the future. Now we all know that much of this may come to pass someday and some of this material is necessary. However, the effect of this present situation on the public is to give them a rather jaded outlook toward space technology. They get the feeling things are easy, things have been achieved that are still many years away. Thus,

if we ever go to the people with pleas for more sacrifice, more taxes, and a bigger effort, and I feel this we must do, then reaction may very well be dubious, in that they feel much of what we want to do is already done.

The National Aeronautics and Space Administration, the Department of Defense, and the other agencies engaged in space flight programs should be encouraged to make better known to the general lay public the implications and serious problems of space technology and space flight. In addition, the impact of a bigger and bolder program in space on the public in terms of the financial support and technical manpower that must be given to these programs should be emphasized now. There must be a correlation between what we predict, what we plan, and what we can do. In other words, the picture must make sense to the layman. The public must be aware of this correlation.

In the area of organization one of the questions being considered today is how best to organize our space effort. There are several ways to do this, such as assigning it all to the military or all to the civilian or a civilian-type agency in the Department of Defense and so one.

The society takes no position as to whether the military or the civilian should control completely the space programs. We feel that it is a mutual problem. It is apparent that there is much scientific knowledge and much scientific utility to be gained from space flight, both manned and unmanned. We do feel, however, that there are definite military implications to this new field.

In addition it must be recognized that military programs have always been better supported financially and received wider public acceptance in all technical areas than strictly civilian programs. Thus a military basis for space technology is a definite advantage.

Any of the several plans for achieving space flight and advancing space technology can be realized provided we have strong technically enlightened leadership in high places and a streamlining of our decision making and planning. This is our biggest problem in this regard.

An excellent approach to this problem is characterized in a report on military research policies by the Rand Corp.

I would like to quote:

[Report R–333, December 4, 1958]

A good development policy will insure that those in technical charge of a program have the authority to take quick advantage of new information gained during development. Such a policy will guard against the tendency for technical decisions to be made at the upper echelons of the military services, or higher. Technically trained contractor and service personnel who are in close touch with a program are in the best position to translate new knowledge into concrete plans for the next stage of development.

In closing, we would like to digress slightly to one area which is often overlooked in its relation to our space program although it has gotten some attention since Sputnik. This area is education. It has been said by several people of high esteem that entirely new types of vehicles may be built and assembled in space. A new technology may arise unrelated to the extrapolated experience with missiles and aircraft. By the same token, much of the predictions for space technology are in the future. We talk of programs in the next 5 years, in the next 10 years, in the next 20. This all presupposes that we are able to maintain a continuous flow of trained, capable technical and

scientific manpower. The boys, and girls for that matter, that we are educating in our elementary schools today are those who will be the young scientists and engineers in the space flight field of the 1970's. I think therefore we need to take a long-term look at education methods and philosophy in order to face the future with confidence.

Considerable criticism has been leveled upon our colleges and school systems. Much of it is well founded. It seems certain that we will not be able to develop and supply the space scientists and engineers of the future unless we have a school system which offers curriculums firmly grounded to fundamentals, a system which teaches orderly thought processes, a system which disciplines the mind for scientific knowledge. Many present elementary and high school systems are not doing this now.

We must start planning and acting now to correct this or there will be no strong leaders in sufficient supply in the coming years to realize the full potential of the space age.

Therefore, it is suggested that this committee should consider, in conjunction with other appropriate committees, the implication of the U.S. educational program on the future of space technology. As I noted before, the United States has tremendous scientific and technical potential. We feel far in excess of the U.S.S.R. However, this potential is constantly being diminished by our conservative approach, by our squabbling over who does what, by our poor utilization of manpower, and over the long pull, by what appears to be a serious deterioration of quality in our educational system. In this diminishing of our potential, we may be like other great world powers before us, sowing the seeds of our own destruction.

Thank you, Mr. Chairman.

The CHAIRMAN. Dr. Arthur, we appreciate very much your statement. You have put your finger on a number of very touchy spots and we will question you about those matters just a little later.

(Dr. Arthur's prepared statement is as follows:)

STATEMENT OF DR. GEORGE R. ARTHUR, PRESIDENT, AMERICAN ASTRONAUTICAL SOCIETY

I should like to express my thanks to the chairman and to the committee members for inviting me here and giving me this opportunity to present the views of the society on this vital subject. I am here in my capacity as president of the American Astronautical Society and although I am trying to present substantially the society's views, it is difficult to keep some of my personal opinions from creeping in. I shall attempt to identify these.

General

I think the best point of departure for this statement is to outline briefly the broad objectives and tenets of the American Astronautical Society, and then to relate this position of the society to the space flight programs and philosophy in the United States today. More particularly, I will relate it to some of the specific programs in space technology.

The American Astronautical Society is composed of scientists and engineers in the astronautical sciences. We are a national scientific organization dedicated to the advancement of the astronautical sciences. The society considers manned interplanetary space flight a logical progression from today's high performance research aircraft, guided missiles, and Earth-satellite operations. The scope of the society is illustrated by the fact that we are interested in all of the scientific disciplines of astronautics and space technology with emphasis on applications.

The aims of the society are to encourage scientific research in all of the fields related to astronautics and to propagate knowledge of current advances. The

society promotes astronautics in this way largely through its program of technical meetings and publications.

Present approach

How then does this relate to the present situation? As noted above, the society believes that manned space flight and all it implies is a logical progression from today's technology. We believe that this is a natural evolution of mankind and that mankind can benefit greatly by the step into space. These benefits have been included and described in detail by other speakers before this committee and include such things as communication satellites, navigation satellites, meterological satellites, and similar items. Are we doing all we can to reap these benefits?

As far as the U.S. program is concerned, the following comments can be made.

The field appears to divide into two major areas:

1. Scientific exploration.
2. Applications of systems.

Sputnik, Vanguard, the Explorers all have been in the first category. The manned systems cover both areas.

It appears that the U.S. program in the area of exploratory by Earth satellite operations is reasonably well in hand. This scientific exploration program has dealt largely with unmanned vehicles.

The one area of exploration where a more rapid rate of development appears warranted and very useful as an aid to applications is the planetary probe.

We now see in retrospect that the program for manned space flight probably got off to a late start, and is now proceeding at only a modest pace. Although some advance planning is in progress at the present time in the manned satellite field, it is felt that the lack of strong support for a substantial follow-on program to Project Mercury is a definite gap in our present space program.

It must be noted that the sixties will be an era of technology and engineering and this is the area where our path is difficult. By technology and engineering, I mean the process of physically realizing in equipment many of the concepts and approaches that have been known for years. These concepts have received much study effort in the past few years and are now on the verge of fruition due to our great strides in propulsion and other technologies which have occurred since World War II. For example, in the area of radiation protection, we are in the process of obtaining much fine scientific information on radiation characteristics. However, if we find it necessary to reduce this to a practical situation by building radiation protection equipment, we find that we are not in very good shape because we have not instituted a comprehensive measuring program on physical damage, due to radiation. In essence, what I am trying to say is that this is the decade of reducing to practice the goals proven feasible in the past. This is where the U.S.S.R. appears to have stolen a march on us.

In the applications area, the U.S.S.R. has no known work but much is suspected. They have an extremely high capability due to the size of their boosters and to the state of their technology in instrumentation and guidance as demonstrated by their lunar shots.

The United States has several programs in the applications area but there is some question whether our work in this field has clearly established long-term goals.

Some applications programs seem to sit on a single approach and refuse to budge until forced. Others proceed in sort of a herky-jerky fashion by jumping to another approach too quickly.

To summarize this point, it appears the U.S. program is a conservative one as there are many areas where we could be bolder, specifically in application areas such as the meteorological satellites, communication satellites, and navigation satellites. We must remember that programs of this type have tremendous potential and we would be in favor of accelerating this type of program independently of any Russian accomplishments.

Information programs

The AAS, as I noted above, also tries to be a technical forum. Anything that can be done to increase the ease of flow of technical information among workers in the field will be an aid. It may be possible in a revised Space Act to implement an easier method of communication between engineers and scientists in the field. If this is done, it will be an aid because it will permit less duplication of effort, which can occur due to ignorance of other work that may be going on.

We recognize, of course, the proprietary information problem and the security problem, but it seems that these are sometimes overworked.

In addition, it would be suggested that the Congress seriously consider some kind of a formal public information program in the space field for the following reasons.

There is a tendency today through the medium of the Sunday supplements and other information media such as TV to engage in what might be called "space charlatanism." The public is constantly besieged by all sorts of predictions, stories, pictures, artists' conceptions and the like about space flight in the future. Now, we all know that much of this may come to pass some day and some of this material is necessary. However, the effect of this present situation on the public is to give them a rather jaded outlook toward space technology. They get the feeling things are easy, things have been achieved that are still many years away. Thus, if we ever go to the people with pleas for more sacrifice, more taxes, and a bigger effort, and I feel this we must do, then reaction may very well be dubious, in that they feel much of what we want to do is already done.

The National Aeronautics and Space Administration, the Department of Defense, and the other agencies engaged in space flight programs should be encouraged to make better known to the general lay public the implications and serious problems of space technology and space flight. In addition, the impact of a bigger and bolder program in space on the public in terms of the financial support and technical manpower that must be given to these programs should be emphasized *now*. There must be a correlation between what we predict, what we plan, and what we can do. In other words, the picture must make sense to the layman. The public must be aware of this correlation.

Organization

One of the questions being considered today is how best to organize our space effort. There are several ways to do this, such as assigning it all to the military or all to the civilian or a civilian-type agency in the Department of Defense and so on.

The society takes no position as to whether the military or the civilian should control completely the space program. We feel that it is a mutual problem. It is apparent that there is much scientific knowledge and much scientific utility to be gained from space flight, both manned and unmanned. We do feel, however, that there are definite military implications to this new field.

In addition, it must be recognized that military programs have always been better supported financially and received wider public acceptance in all technical areas than strictly civilian programs. Thus a military basis for space technology is a definite advantage.

Any of the several plans for achieving space flight and advancing space technology can be realized provided we have strong technically enlightened leadership in high places and a streamlining of our decision making and planning. This is our biggest problem in this regard.

An excellent approach to this problem is characterized in "Report on Military Research Policies" by the Rand Corp.: [1]

"A good development policy will ensure that *those in technical charge of a program have the authority to take quick advantage of new information gained during development*. Such a policy will guard against the tendency for technical decisions to be made at the upper echelons of the military services, or higher. Technically trained contractor and service personnel who are in close touch with a program are in the best position to translate new knowedgle into concrete plans for the next stage of development."

To answer now the question of the military basis in space technology we know some people feel the military has no role in space. This is not the case. As to what are the military implications of space, actually these are relatively undefined at this point. However, there is no question that space is a military objective. Mainly for the following reason—if an area can be controlled, if only partially, by a power unfriendly or possibly unfriendly to the United States and controlled in such a fashion that it is dangerous to the United States, then this area immediately becomes a military objective or at least control of it does. In the simple sense then, the use of this area must be denied to the unfriendly power. No thought has been given to the method by which this denial can be

[1] Rept. R–333, Dec. 4, 1958.

achieved but it seems that this situation does exist and therefore space is in essence a military objective, in addition to a scientific frontier.

If you will permit me to add my voice to answering an overworked question: Why do we want to compete with the Soviet Union in this field? My answer is the same as that given by others. This is a situation in which we must face reality. Whether we like it or not, the United States must be in this race with the Soviet Union. We cannot afford to let this go by default. Our reputation and our political strength in the world are directly dependent on our achievements in scientific enterprises and especially in astronautics.

Education

In closing, I would like to digress slightly to one area which is often overlooked in its relation to our space program although it has gotten some attention since sputnik. This area is education. It has been said by several people of high esteem that entirely new types of vehicles may be built and assembled in space. A new technology may arise unrelated to the extrapolated experience with missiles and aircraft. This means that we are building a new breed of cat, a composite of electronic-missile-airplane engineer if you like. By the same token, much of the predictions for space technology are in the future. We talk of programs in the next 5 years, in the next 10, in the next 20. This all presupposes that we are able to maintain a continuous flow of trained capable technical and scientific manpower. The boys, and girls for that matter, that we are educating in our elementary schools today are those who will be the young scientists and engineers in the space flight field of the 1970's. I think therefore we need to take a long-term look at education methods and philosophy in order to face the future with confidence. I should like to enter into the record at this point an editorial which appeared in the AAS publication, the Astronautical Sciences Review, vol. 1, No. 3, July-September 1959.

"Although we are proud of the contributions of many of the early workers in rocketry and space flight in the United States, it must be noted that our favorable position today in space technology, even though tenuous, is due also to the efforts and dedication of a group of scientists who did not receive their education or initial experience in this country. These were the men who pioneered in Germany and other areas for space flight and rocket propulsion in the early thirties. These were the men whose efforts were diverted to a military application in the forties. These were the men who, fortunately, were able to become citizens and workers in this country. Though a major portion of this group has remained as part of a single operation, a certain amount of healthy diffusion to other areas of Government and industry has occurred.

"Through their zeal and determination, these men have instilled some of the younger technical people in this country with the same spirit and doggedness that marked many of their efforts in their most early experiments. This has helped the United States to build a number of top space technology teams throughout Government and industrial installations.

"But, what does the future hold? Are there young men and women coming along to pick up the torch from these pioneering scientists and engineers? We must remember that many of the plans that detail the future of space flight achievements will occur 20, 30, even 40 years from now. We are today educating in our elementary schools and in our junior high schools the youth who must realize these achievements in space technology in the future years. Considerable criticism has been leveled upon our colleges and school systems. Much of it is well founded. It seems certain that we will not be able to develop and supply the space scientists and engineers of the future unless we have a school system which offers curricula firmly grounded to fundamentals, a system which teaches orderly thought processes, a system which disciplines the mind for scientific knowledge. The present elementary and high-school systems are not doing this now.

"Much thought has been given to correcting our colleges, but is this really where our initial correction must occur? A house is build upon a foundation. The foundation of our educational system is the elementary school. If the elementary schools are not supplying the firm foundation so necessary for future success the house will surely crumble under the future stresses we know will occur.

"We must start planning and acting now to correct this or there will be no Van Allens from our schools, surely no von Brauns, and in general no strong leaders in sufficient supply in the coming years to realize the full potential of the space age."

Therefore, it is suggested that this committee should consider, in conjunction with other appropriate committees, the implication of the U.S. educational program on the future of space technology. As I noted before, the United States has tremendous scientific and technical potential. This potential is constantly being diminished by our conservative approach, by our squabbling over who does what, by our poor utilization of manpower, and over the long pull by what appears to be a serious deterioration of quality in our educational system. In this diminishing of our potential, we are like other great world powers before us, sowing the seeds of our own destruction.

APPENDIX

1960 Board of Directors of the American Astronautical Society, New York, N.Y.

Name and AAS title	*Business*
George R. Arthur (Dr.), president	Advanced space systems, General Electric Co., Missile and Space Vehicle Department.
William Whitson (Dr.), vice president	Daystrom, Inc.
Robert Young, vice president	ACF Electronics.
John J. Campbell, treasurer	Radio Corp. of America.
Fernand F. Martin, secretary	RCA Airborne Systems Department.
Col. Paul Butman, director at large (1960)	USAF–ARDC.
John Crone, director at large (1960)	Airtronics, Inc.
Maj. Gen. William W. Dick, Jr., director at large (1960).	USA, Office of Army Research.
Edward H. Heinemann, director at large (1960).	Douglas Aircraft Co.
Robert E. Roberson (Dr.), director at large (1960).	Systems Corp. of America.
Cmdr. Malcolm D. Ross, director at large (1960).	Office of Naval Research.
Sydney S. Sherby, director at large (1960)	Hiller Aircraft Corp.
Ross Fleisig, director at large (1961)	Sperry Gyroscope Co.
Robert P. Haviland, director at large (1961)	General Electric Co., Missile and Space Vehicle Department.
Alexander Kartveli, director at large (1961)	Republic Aviation Corp.
Donald H. Menzel (Dr.), director at large (1961).	Harvard University.
Austin Stanton, director at large (1961)	Varo Manufacturing Co.
Ernst Stuhlinger (Dr.), director at large (1961)	Army Ballistic Missile Agency.
Robert M. Bridgforth, Jr., director at large (1962).	Boeing Airplane Co.
Col. Paul A. Campbell, director at large (1962)	USAF School of Aviation Medicine.
Brig. Gen. Robert Greer, director at large (1962).	USAF Deputy Assistant Chief of Staff for Guided Missiles.
Alfred M. Mayo, director at large (1962)	Douglas Aircraft Co.
Norman V. Petersen, director at large (1962)	Northrop Corp.
S. Fred Singer (Dr.), director at large (1962)	University of Maryland.
James A. VanAllen (Dr.), director at large (1962)	State University of Iowa.

The CHAIRMAN. The third witness that we have this morning, gentlemen of the committee, is Dr. H. Guyford Stever, representing the Institute of the Aeronautical Sciences for Gen. Donald Putt, who asked that he appear in his place. Dr. Stever has been before this committee previously, and his biography is before the members. Dr. Stever was formerly Chief Scientist of the Air Force, and headed the advisory committee which prepared the NACA for transformation into a space agency. He is presently a dean and professor at the Massachusetts Institute of Technology. He will present the statement of the Institute of the Aeronautical Sciences.

(The biography follows:)

[From "American Men of Science," vol. I]

BIOGRAPHY OF DR. H. GUYFORD STEVER

Stever, Prof. Horton Guyford, Department of Aeronautical Engineering, Massachusetts Institute of Technology, Cambridge, 1939; Massachusetts Aeronautics. B. Corning, N.Y., Oct. 24, 1916; married 1946; children, 3. A.B. Colgate, 1938, Ph. D. (physics), California Institute of Technology, 1941. Staff member, radiation laboratory, Massachusetts Institute of Technology and instructor radar techniques, Army-Navy Officers Radar School, 1941–42; technical liaison officer, London mission, Office Scientific Research and Development, 1942–45; member secretariat, national guided missile committee, Joint Chiefs of Staff, 1945; executive officer, guided missile program, Massachusetts Institute of Technology, 1945–47, assistant professor aeronautical engineering, 1946–51, associate professor, 1951; aeronautical consultant to industry, 1946, member guided missiles technical evaluation group, research and development board, 1946–48; air defense systems engineer command, U.S. Air Force, 1949–51; technical advisory panel ordnance U.S. Department of Defense, 1954; Presidential Certificate of Merit, 1948. Member Science Advisory Board, USAF, 1947. A.A.; fellow Physical Society; associate fellow Institute Aeronautical Science; fellow American Academy. Gas discharge; Geiger counters; cosmic rays; radar guided missiles; hypersonic aerodynamics; shock tubes; transonic aircraft; nuclear propulsion of aircraft; condensation in high speed flow.

The CHAIRMAN. Dr. Stever, we are happy to have you.

Dr. STEVER. Thank you, Mr. Chairman.

STATEMENT OF DR. H. GUYFORD STEVER, INSTITUTE OF THE AERONAUTICAL SCIENCES

We consider it a pleasure and a privilege to appear before your committee in response to your chairman's invitation. We recognize the importance of the work that your committee and the other committees of the Congress are doing in their effort to maintain the position of scientific and technological leadership which the country has long enjoyed.

Just as the Congress is the open forum in which economic, military, and political matters concerning the welfare of the United States are debated, so our scientific societies make up the forum in which scientists and engineers expose new theories and advanced ideas for debate and discussion in the presence of their colleagues. In this way science and engineering are advanced, and the body of basic scientific knowledge grows.

The Institute of the Aeronautical Sciences—

(*a*) Facilitates through its meetings and its publications the rapid interchange of scientific and technical information among the 15,000 scientists, engineers, educators, and industrialists which comprise its graded membership; and

(*b*) Encourage qualified students in our schools and universities to prepare themselves for positions of leadership in the aerospace sciences. It has some 5,000 students enrolled in branches at some 80 universities in the country.

The details of how we do these jobs are contained in the prepared statement and also in the appendixes thereto and I won't spend time here this morning discussing that. Let me say that we hold meetings, some of which are classified. We hold inspection trips both for our adult members and also our student members.

The institute's only mandate under its charter is to advance the aerospace sciences. Its sole objective is to raise the level of the country's scientific and technical competence in the aerospace sciences so there will always be an adequate number of qualified technical people to maintain our technological leadership.

With the above in mind, it is clear that we cannot come before your committee today to speak as an organization as to what should constitute specific goals in space research, development, and operations. These are questions of national policy which must be determined by the executive and the legislative branches of Government. The Defense Department must set the requirements for national security and conduct the necessary military space programs. Under the National Aeronautics and Space Act of 1958, the National Aeronautics and Space Administration has the responsibility to plan for and to conduct the nonmilitary aspects of space exploration. The Congress, after considering national policy objectives and the state of the national economy, must decide on desirable rates of development and optimum levels of operations for the space program.

Individually, many officers and members of this institute cooperate with and assist many agencies of Government in evaluating specific proposals and in determining properly balanced programs in aeronautics and in space technology. As individuals, many of them have strong personal views on such subjects.

And I may say parenthetically quite often express them as individuals.

Some of them have undoubtedly testified before your committee. As your chairman has pointed out, I have been here before. It would be quite presumptuous for us as an organization, however, to appear before you to recommend this or that specific program, or to suggest that more or less money be allocated to one or to the other of the armed services in support of one weapons system over another. We are not equipped to do so. Such things are outside the scope of our charter.

As an organization, however, we believe strongly in the necessity and in the urgency of extending the boundaries of human knowledge of the universe in which we live. New techniques developed in the past decade have opened up possibilities for exploration and for exploitation of space at speeds and at altitudes ranging from zero out to infinity. I know Mr. Fulton will enjoy our mentioning infinity with respect to speeds.

It is essential that we take full advantage of these capabilities both for the betterment of our people and for the security of our country.

Mr. Fulton. May I interrupt to say not only enjoyed it, but I compliment you. Your perspicuity is equal only to your perspicacity.

Dr. Stever. At the same time, we must not allow ourselves to be completely distracted by these glamorous new capabilities. Few people now living will experience space travel or participate personally in space exploration. For the foreseeable future, by far the bulk of human travel, and, in fact, the major theaters of military conflict, will be restricted to the surface of the Earth, or the thin shell of atmospheric air which envelops it. Every space vehicle must transit the atmosphere on its outward track, and must cope with complex re-

entry problems on its return. We must, therefore, not overlook or neglect the aeronautical aspects of the aerospace sciences.

Our aerospace programs for national welfare and for national security must be properly balanced if they are to be effective.

Activities such as ours contribute directly to the ability of the country to meet such challenges by improving the technological capabilities of our scientists and engineers. In recent years there has been a marked shift in the interests and activities of our members from air-breathing aircraft and their components and research problems, to ballistic missiles, space vehicles and the associated space technology. (See app. D.) This did not start at the launching of Sputnik I, but was already underway by the end of World War II. In the following decade, although space vehicles were seldom mentioned as such, many of the papers presented in institute meetings dealt with scientific subjects on which present technology is based.

Leading aerospace engineering, scientific, and industrial people in this country are members of this institute. They are graduates of our great universities and engineering schools. Many of them have had up to half a century of background and experience in their profession. (See app. B.) We believe that membership in the institute has added to their capabilities.

The United States has a responsibility for world leadership. This leadership is compounded of many factors, and any nation aspiring for leadership must be a leader in all major factors involved. The past decade has seen science and technology emerge as a dominant factor in world affairs. Military, political, economic, and social decisions cannot be made without consideration of the influence of science and technology in such areas. Not only is technology the foundation of our national prosperity but also of our military strength. It is essential, therefore, that we adopt every possible means to expand and to improve our human resources in the scientific and engineering fields.

This last point that I would like to make is a point on which we, the institute, do feel that we can make an authoritative statement. The technological potential of this country as represented by engineers, scientists, and technical managers is sufficient to meet any challenge. Within the membership of the scientific societies, many of them represented here, there is a vast reservoir of highly trained and experienced men.

Further, many of them are helping to train personnel. Many are already engaged in the aerospace program of the country but there exists in other sections of the economy a great capability for emergency expansion as was convincingly demonstrated in World War II. We are certain that U.S. engineers and scientists can meet any demands that national policy may dictate. The institute will continue its effort to improve the professional competence of its membership and stands ready and willing to assist in any or all programs in the aerospace sciences which the Congress in its wisdom sees fit to establish.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Dr. Stever. We appreciate your appearance before the committee and for giving us an excellent statement which will cause our membership to do a lot of thinking.

(The full text of Dr. Stever's statement is as follows:)

STATEMENT SUBMITTED BY THE INSTITUTE OF THE AERONAUTICAL SCIENCES TO THE COMMITTEE ON SCIENCE AND ASTRONAUTICS, HOUSE OF REPRESENTATIVES, FEBRUARY 23, 1960

PART I—POLICY STATEMENT

We consider it a pleasure and a privilege to appear before your committee in response to your chairman's invitation. We recognize the importance of the work that your committee and the other committees of the Congress are doing in their effort to maintain the position of scientific and technological leadership which the country has long enjoyed. It is vital that we retain this leadership as a guarantee of our national security, and of our future economic welfare.

We appreciate the committee's inclusion of certain scientific and technical societies on its list of witnesses in the area of aerospace technology. Just as the Congress is the open forum in which economic, military, and political matters concerning the welfare of the United States are debated, so our scientific societies make up the forum in which scientists and engineers expose new theories and advanced ideas for debate and discussion in the presence of their colleagues. In this way science and engineering are advanced, and the body of basic scientific knowledge grows.

As a scientific society dedicated to the advancement of the art and science of aerospace technology, the Institute of the Aeronautical Sciences engages in two principal forms of activity:

(*a*) It facilitates through its meetings and its publications the rapid interchange of scientific and technical information among the 15,000 scientists, engineers, educators, and industrialists which comprise its graded membership;

(*b*) It encourages qualified students in our schools and universities to prepare themselves for positions of leadership in the aerospace sciences. It has some 5,000 students enrolled in branches at some 80 universities in the country.

Institute meetings are organized at national, regional, and sectional levels. Subjects range over the whole spectrum of matters relating to aerospace science and technology. In any calendar year, (not counting meetings held by student branches) their number averages one per working day. Nearly 600 papers are prepared and presented at such meetings yearly, many of which are published in IAS journals or periodicals.

Supplementing the regular meetings, frequent briefings, and inspection trips to Government R. & D. and testing facilities are organized. Most of these are classified, and all are carefully controlled by the sponsoring agency for security. Such field trips offer invaluable opportunity for Government and industry personnel to exchange ideas on an informal basis.

The IAS student program includes periodic branch meetings as well as annual regional conferences. Vocational guidance material for high school students is compiled and distributed on a countrywide basis. (See pt. II and appendixes.)

To service the professional needs of its membership the institute maintains two technical libraries, one in New York and one in Los Angeles. In addition to making available up-to-date books, periodicals, and reports, these libraries produce voluminous monthly abstracts of pertinent literature in the aerospace sciences from all sources, including the U.S.S.R. These appear monthly in IAS publications.

The institute is also the custodian of a number of annual awards to honor outstanding contributions by individuals to progress in the aerospace sciences. The most recent, and of particular interest to your committee, is the Hill Space Transportation Award. (See app. G.)

The institute's only mandate under its charter is to advance the aerospace sciences. Its sole objective is to raise the level of the country's scientific and technical competence in the aerospace sciences so that there will always be an adequate number of qualified professional people available to maintain our technological leadership.

With the above in mind, it is clear that we cannot come before your committee today to speak *as an organization* as to what should constitute specific goals in space research, development, and operations. These are questions of national policy which must be determined by the executive and the legislative branches of Government. The Defense Department must set the requirements for national security and conduct the necessary military space programs. Under the Na-

tional Aeronautical Space Act of 1958, the National Aeronautics and Space Agency has the responsibility to plan for and to conduct the nonmilitary aspects of space exploration. The Congress, after considering national policy objectives and the state of the national economy, must decide on desirable rates of development and optimum levels of operations for the space program.

Individually, many officers and members of this institute cooperate with and assist many agencies of Government in evaluating specific proposals and in determining properly balanced programs in aeronautics and in space technology. As individuals, many of them have strong personal views on such subjects. Some of them have undoubtedly testified before your committee. It would be quite presumptuous for us as an organization, however, to appear before you to recommend this or that specific program, or to suggest that more or less money be allocated to one or to the other of the armed services in support of one weapons system over another. We are not equipped to do so. Such things are outside the scope of our charter.

As an organization, however, we believe strongly in the necessity and in the urgency of extending the boundaries of human knowledge of the universe in which we live. New techniques developed in the past decade have opened up possibilities for exploration and for exploration of space at speeds and at altitudes ranging from zero out to infinity. It is essential that we take full advantage of these capabilities both for the betterment of our people and for the security of our country.

At the same time we must not allow ourselves to be completely distracted by these glamorous new capabilities. Few people now living will experience space travel or participate personally in space exploration. For the foreseeable future, by far the bulk of human travel and, in fact, the major theaters of military conflict, will be restricted to the surface of the Earth, or to the thin shell of atmospheric air which envelops it. Every space vehicle must transmit the atmosphere on its outward track, and must cope with complex reentry problems on its return. We must, therefore, not overlook or neglect the aeronautical aspects of the aerospace sciences. Many difficult and complicated problems yet remain to be solved before we can attain complete mastery of the ocean of air in which we all are living. Our aerospace programs for national welfare and for national security must be properly balanced, if they are to be effective.

Activities such as ours contribute directly to the ability of the country to meet such challenges by improving the technological capabilities of our scientists and engineers. In recent years there has been a marked shift in the interests and activities of our members from air-breathing aircraft and their components and research problems, to ballistic missiles, space vehicles and the associated space technology. (See app. D.) This did not start at the launching of Sputnik I, but was already underway by the end of World War II. In the following decade, although space vehicles were seldom mentioned as such, many of the papers presented in institute meetings, dealt with scientific subjects on which present technology is based.

Leading aerospace engineering, scientific, and industrial people in this country are members of this institute. They are graduates of our great universities and engineering schools. Many of them have had up to half a century of background and experience in their profession. (See app. B.) We believe that membership in the institute has added to their capabilities.

The United States has a responsibility for world leadership. Leadership is compounded of many factors, and any nation aspiring for leadership must be a leader in all major factors involved. The past decade has seen science and technology emerge as a dominant factor in world affairs. Military, political, economic, and social decisions cannot be made without consideration of the influence of science and technology in such areas. Not only is technology the foundation of our national prosperity but also of our military strength. It is essential, therefore, that we adopt every possible means to expand and to improve our human resources in the scientific and engineering fields.

The technical potential of this country, as represented by engineers, scientists, and technical managers is sufficient to meet any challenge. Within the membership of the scientific societies there is a vast reservoir of highly trained and experienced men. Many are already engaged in the aerospace program of the country but there exists in other sections of the economy a great capability for emergency expansion as was convincingly demonstrated in World War II. We are certain that U.S. engineers and scientists can meet any demands that national policy may dictate. The institute will continue its efforts to improve the professional competence of its membership and stands

ready and willing to assist in any or all programs in the aerospace sciences which the Congress in its wisdom sees fit to establish.

PART II—IAS ORGANIZATION AND ACTIVITIES

(The material presented in part II and in the appendixes to this report covers the organization and activities of the institute and is submitted for the general information of the members of the committee.)

I. THE IAS ORGANIZATION

The IAS was organized in 1932 "as a nonprofit scientific and engineering membership society to advance the arts and science of aerospace technology." The governing body of the IAS is its council. Council members and officers are elected by the membership. Its activities are supported by a permanent staff with headquarters at 2 East 64th Street in New York City. The relationship of these elements is shown on the chart attached (app. A). A list of the past presidents of the IAS for the past 20 years and a list of its present officers and council are included as appendix B.

The membership of the IAS has shown a consistently regular growth since its founding. Appendix C includes a chart showing its growth history, and includes some discussion of its basic operating philosophy.

At the end of 1958, in order to give some perspective for long-range planning, a 5-year summary of IAS activities was prepared. A copy of this report is attached as appendix D.

II. PROGRAMS FOR ATTAINING IAS OBJECTIVES

To facilitate the rapid interchange of scientific and technical information in the aerospace sciences, and to advance the state of the art, the IAS performs the following major services:

1. It organizes and conducts technical meetings of current interest to its members at national, regional, local, and university levels. Such meetings are open forums for free discussion of new scientific and technical ideas. They bring together men of widely diversified interests and of broad geographical location. Subjects may be "open" or classified. Where classified material is involved, proper security safeguards covering attendees and meeting places are maintained with the cooperation of some qualified agency of government (e.g., Air Force, Navy, etc.). Typical examples are included in appendix E.

2. It organizes, in cooperation with pertinent Government agencies, briefings and inspections of research and development and testing facilities for aerospace science. Such visits are usually of a classified nature with all attendees cleared and qualified as to "need to know" by the cognizant agency. These activities have proven to be extremely valuable in promoting interchange of ideas on a broad and informal basis, between top industrial R. & D. and management personnel and the representatives of Government. For a typical program see also appendix E.

3. It publishes scientific and engineering periodicals and monographs. (Examples are included in app. F.) No classified material is published by the IAS. Whenever classified material generated in IAS meetings is selected for publication, the responsibility for such publication, and subsequent distribution, is handled by some qualified Government agency (e.g., U.S. Navy, Air Force, ASTIA, etc.).

4. The institute maintains extensive and scientific libraries covering all phases of the aerospace sciences in New York and in Los Angeles. These libraries contain not only books and reference material but also the current periodicals in the field. Abstracting and indexing services are performed by both libraries to keep industry currently informed of available literature. Such abstracts are published monthly in Aero/Space Engineering, a copy of which is included in appendix F.

5. The IAS recognizes outstanding achievement by individuals in the aerospace sciences through honorary fellowships in the institute, and through the presentation of a number of annual awards, many of which include honoraria. These include the Chanute Award for research pilots; the Jeffries Award in the field of aerospace medicine; the Losey Award for meteorology; the Reed Award for scientific research; the Sperry Award for outstanding contribution by a young man; and the Hill Space Transportation Award, to encourage peaceful exploration of space, which carries with it an honorarium of $5,000 to $10,000. (See app. G.)

6. The institute encourages qualified students in schools and universities to follow scientific and technical courses and to specialize in advanced work in the aerospace sciences. To accomplish this, the IAS maintains student branches in some 80 U.S. universities. It conducts half a dozen regional student conferences in various parts of the country annually. It encourages the preparation of scientific papers by students, offering prizes and eventual publication of the best, as selected by committees of prominent scientists. (Typical student conference program included in app. J.)

7. It participates in advanced fellowship programs (e.g., IAS flight-test-engineering fellowship, brochure attached, app. H).

8. The IAS prepares and distributes vocational guidance material for the use of counselors and students at the high-school level. During the past 5 years, over 300,000 copies of such booklets have been printed and distributed. A revised edition emphasizing the newer opportunities in the aerospace sciences (100,000 copies) is now in the process of distribution (copy attached, app. J).

(NOTE.—Copy of IAS literature outlining membership requirements for individuals, students, and corporate members is included in app. K.)

APPENDIXES

(Appendixes A, C, D, E, F, G, H, I, J, and K are on file with the committee, and are too long to reproduce here. Appendix B is as follows:)

APPENDIX B

IAS Officers and Council, 1960

President: Lt. Gen. Donald L. Putt, USAF (retired), president, United Technology Corp.

Vice president (central): Col. Paul H. Dane, USAF, professor of thermodynamics, USAF Academy.

Vice president (western): Harold Luskin, staff assistant to manager, satellite systems, missiles & space division, Lookheed Aircraft Corp.

Vice president (eastern): Charles Tilgner, Jr., chief aeronautical engineer, Grumman Aircraft Engineering Corp.

Treasurer: Victory E. Carbonara, president, Kollsman Instrument Corp.

Council members:

Peter Altman, vice president, Research and Development Division, Continental Motors Corp.

John S. Attinello, assistant to chief engineer, Aircraft & Missiles Division, Fairchild Engine & Airplane Corp.

Preston R. Bassett, former president, Sperry Gyroscope Corp. (retired).

R. C. Blaylock, vice president, engineering, Chance-Vought Aircraft, Inc.

Rear Adm. C. M. Bolster, U.S.N. (retired), coordinator development, the General Tire & Rubber Co.

Milton U. Clauser, vice president and director, Physical Research Laboratory, Space Technology Laboratories.

Rear Adm. Luis de Florez, U.S.N. (retired), the de Florez Co., Inc.

Preston E. Dickson, group engineer, aerodynamics, Beech Aircraft Corp.

George F. Douglas, vice president, engineering, Norair Division, Northrop Corp.

Hubert I. Flomenhoft, group leader, flight loads dynamic science section, North American Aviation, Inc.

Welko E. Gasich, director, weapon system development engineering, Northrop Corp.

Donald P. Germeraad, chief engineering test pilot, Convair Division, General Dynamics Corp.

Nicholas J. Hoff, head, division of aeronautical engineering, Stanford University.

Lawrence Levy, president, Allied Research Associates, Inc.

William Littlewood, vice president, equipment-research, American Airlines, Inc.

Axel T. Mattson, head, Eight-Foot Tunnel Branch, Langley Research Center, NASA.

Clyde R. Murtaugh, flight sciences department, Bendix Systems Division, Bendix Aviation Corp.

Vernon Outman, chief technical engineer, McDonnell Aircraft Corp.
L. Eugene Root, group vice president, Lockheed Aircraft Corp.
William R. Sears, director, Graduate School of Aeronautical Engineering, Cornell University.
R. Dixon Speas, R. Dixon Speas Associates.
H. Guyford Stever, associate dean of engineering, MIT.
Y. A. Yoler, head, flight sciences laboratory, Boeing Airplane Co.

Past Presidents, IAS, 1940–60 (in Alphabetical Order)

J. L. Atwood, president, North American Aviation, Inc.
Preston R. Bassett, retired, formerly president, Sperry-Gyroscope Co.
Wellwood E. Beall, senior vice president, Boeing Airplane Co.
W. A. M. Burden, U.S. Ambassador to Belgium.
Frank W. Caldwell, consulting engineer, formerly with United Aircraft Corp.
Charles H. Colvin, president, Colvin Laboratories, Inc.
J. H. Doolittle, USAF (retired), chairman, board of directors, Space Technology Laboratories, Inc.
Hugh L. Dryden, Deputy Administrator, NASA.
R. H. Fleet, retired, founder of Convair.
Robert E. Gross, chairman of the board, Lockheed Aircraft Corp.
Hall L. Hibbard, senior vice president, Lockheed Aircraft Corp.
J. H. Kindelberger, chairman of the board, North American Aviation.
William Littlewood, vice president, equipment-research, American Airlines, Inc.
C. J. McCarthy, chairman of the board, Chance Vought Aircraft, Inc.
J. K. Northrop, engineering consultant, formerly president, Northrop Corp.
Mundy I. Peale, president, Republic Aviation Corp.
A. E. Raymond, senior vice president, engineering, Douglas Aircraft Co., Inc.
L. B. Richardson, USN (retired), senior vice president, General Dynamics Corp.
E. R. Sharp, Director, Lewis Research Center, NASA.
E C. Wells, vice president, engineering, Boeing Airplane Co.

The CHAIRMAN. The fourth witness that we have set this morning is Dr. Lloyd V. Berkner, Chairman of the Space Sciences Board of the National Academy of Sciences.

Although we do not have a written acknowledgement of the committee's invitation to appear, mailed as it was on January 27, I understand that the Space Sciences Board may file a written statement for inclusion in the record rather than have Dr. Berkner or any other member of the Space Sciences Board or their executive secretary appear today.

To the best of my knowledge, this important group has never sought nor encouraged any contact with the only science committee of the Congress; namely, our committee.

I want to say this, of course, we are a new committee and we know it. Dr. Berkner probably doesn't realize that we are a new committee charged with responsibility in this respect, but I am informed by our staff that the Space Sciences Board receives every dollar of its finances from NASA and, therefore—is that correct?

Dr. SHELDON. And the National Science Foundation.

The CHAIRMAN. And National Science Foundation.

Therefore, we have a responsibility to hear from them as to the type of work and the character of work and the quality of work which they are doing.

We hope that Dr. Berkner will send up an excellent statement for incorporation in the record in lieu of his own personal appearance. We will wait and see.

Mr. FULTON. Mr. Chairman, on that——

The CHAIRMAN. Yes.

Mr. FULTON. May I say that Dr. Berkner is busy and I imagine most members of the Space Sciences Board are pretty busy, so that

we realize they have a difficult problem of meeting many deadlines. Dr. Berkner had appeared before our select committee, as you remember, which was the predecessor committee to this particular committee, had given fully of his time and made very good statements. So I think he has previously cooperated and I think he will in the future.

The CHAIRMAN. I think this: I don't want us to be critical of these things that come up from time to time. We are a new committee, of course, and the average individual will have to be acquainted with our operations and our needs.

On the other hand, we want to tell Dr. Berkner that we missed him on this occasion.

(The statement promised for the record has not been received.)

The CHAIRMAN. The fifth witness is Mr. Nelson P. Jackson, president of the National Rocket Club, which held a few days ago the successful missile/space age conference here in Washington. His biography is also before the members of this committee. He is also manager of the government office of the Joy Manufacturing Co. He will present the statement of the National Rocket Club.

[Furnished by National Rocket Club]

BIOGRAPHY OF NELSON P. JACKSON, PRESIDENT, NATIONAL ROCKET CLUB, WASHINGTON, D.C.

Engineer, lawyer, pilot, consultant, Nelson P. Jackson, is manager of the government office of Joy Manufacturing Co., a manufacturer of heavy equipment, whose products are used in missiles and on launchers, ground support equipment, aircraft, and submarines, and in construction work. Before joining Joy in 1959, he practiced law in Washington and, during that time, authored papers on "Education for the Space Age" and "The Law of Outer Space."

From 1954 to 1958 Mr. Jackson handled nuclear activities for General Electric Co. in Washington. At this time he was chairman of an atomic energy advisory group and published several articles on "Nuclear Powerplants," "Atomic Energy Economics," and "The Disposal of Atomic Wastes."

A 1933 graduate of West Point, he served as a fighter pilot, first in the Army Air Corps, later in the Air Force. His service included an assignment with the Joint Chiefs of Staff, atomic energy work, Strategic Air Command experience, command of a fighter wing in combat during World War II, 19 decorations, and the grade of colonel.

Mr. Jackson is married and is the father of five children. He is a member of a number of professional, technical, and social groups connected with his wide background of interests.

The CHAIRMAN. Mr. Jackson, we welcome you and happy to have your statement, either verbally or with reference to the written statement.

Mr. FULTON. Could we on the Republican side likewise welcome Mr. Jackson, both in his capacity as the newly reelected, unanimously reelected president of the National Rocket Club, and also as the husband of one of the prettiest wives in Washington and father of five children. [Laughter.]

The CHAIRMAN. Well he has five rocketeers.

Mr. MILLER. Mr. Jackson, that coming from a bachelor has great significance.

The CHAIRMAN. We are happy to have your statement, sir. Don't let that byplay distract you from the fundamental goal we are working toward.

Mr. FULTON. Just so Mr. Miller—I withheld the point, actually the Joy Manufacturing Co. is from Pittsburgh, Pa.

Mr. JACKSON. Thank you, Mr. Chairman, Mr. Fulton, Mr. Miller, and other members of the committee.

STATEMENT OF NELSON P. JACKSON, PRESIDENT, NATIONAL ROCKET CLUB

The National Rocket Club appreciates the invitation that you extended to us to come up here and give you some of our views on the problems that are before us, as a nation.

The handles of the illustrious gentlemen on my left, all being doctors, indicate a cleavage of ideas between their organizations and the one I represent. Mine is more of a businessman's organization—management in industry and in Government, with a lot of press members and a few members from here on the Hill. The National Rocket Club is described in appendix A attached hereto.

I am a member of two of the technical societies on the left, the American Rocket Society and the Institute of the Aeronautical Sciences as are a number of members of the Rocket Club, but most of us do not practice at being engineers or scientists. We are peddlers or do some other kind of activity.

I took up your invitation with the club at its annual membership meeting the other day, and they decided that I should come before you and speak pretty much as an individual except on one item which I will identify later on.

It was agreed that I could give you some thoughts expressed at the 1960 National Missile/Space Conference held in Washington last week and to add some of my own ideas.

The theme of this year's National Missile/Space Conference was "The Space Challenge As It Confronts the United States and the Free World." Our objective was to promote policies, programs, and legislation necessary to establish and maintain U.S. space leadership, and to stimulate civil and military space programs for the benefit of mankind. There were four panel sessions of the conference, two luncheons, two receptions, and the Goddard dinner. The agenda for all of this is attached as appendix B.

We were honored to have several members of this committee participate with us. The opinions of conference panelists varied from praise of our progress through 1959, to deploring our absence of competitiveness in space; from plugs for Saturn and Centaur booster programs, to urging the development of a nuclear-chemical rocket program; from using space as a colonizing medium for excess world population, to using it as a place for future wars; from urging acceptance of the status quo re NASA and DOD responsibilities in space, to plugging for more unification of our military and nonmilitary space programs; from using the Moon for colonization by excess people on the Earth, to using the Moon as a military base from which to control any area of the Earth; from our need to surpass Soviet achievements in space in order to recover our prestige throughout the world, to ignoring or belittling such Russian ascendancy; from a hesitancy to spend huge sums for space activities until our goals there are clear, to accepting and supporting $4 billion more per year that some think it will take to catch up with and overtake the Russians; from full international cooperation in space—through varying degrees of cooperation—to going it alone.

Luncheon speakers covered problems of the space age and the missile/space industry, and the Goddard dinner speaker told about U.S. achievements in planning and executing our missile and space programs.

The proceedings of the 1960 National Missile/Space Conference are not yet available. When they are, the National Rocket Club will mail a copy to each member of this committee.

In my opinion the hearings that this and the other interested committees of both Houses of Congress are and will be holding will help to clarify our goals in space and will stimulate and arouse public opinion to see that the administration carries on or steps up its activities to achieve success.

There are doubts and hesitations about some of our national requirements in space—military, scientific, prestigewise. The proper resolution of these doubts could mean national and free world survival. With the stakes so potentially high but still somewhat unclear, I recommend the expenditure of an additional $4 billion per year for military and scientific all-out efforts in space. This would amount to less than 1 percent of our gross national product, only 6 percent of our total national budget, less than $25 per year per U.S. citizen—a bargain price for what could be survival.

Russia is apparently building incentives for its engineers and manufacturers to produce for its state. Here in the United States it seems to be fashionable to destroy free enterprise incentives—at least in selling to the Government. Our national strength lies in free enterprise, among other things—in the incentive of the individual. Sociological and economic theories that seem to be fashionable make it appear as though there is something wrong in making a profit, particularly wrong in making a profit on sales to the Government. Our Government procurement system has thus become so distorted over the last few years that we are destroying incentive. We find companies preferring to sell their products commercially rather than to Government. Practices that seem to me to be destructive of incentive are (1) tight procurement; (2) audit piled on audit as (*a*) by a military service, (*b*) by the General Accounting Office, and (*c*) maybe by a renegotiation board; (3) under National Aeronautics and Space Administration contracts, patentable ideas are the Government's and may not be used in commercial work; (4) renegotiation; (5) acquisition of proprietary technical data and know-how.

In our competition with Russia over space, we will uncover new technologies in the carrying out of NASA contracts. Some of these technologies will have applications on Earth, but the Government will have all the rights to them—and we'll find ourselves backing into socialism.

I recommend the fostering of a climate of Government contracting whereby our corporate citizens, our industrial companies, will retain their incentive to serve our country.

Lastly, and on this recommendation, I speak for the National Rocket Club as a whole, I recommend the establishment by Congress of March 16 as Goddard Day in honor of our great rocket pioneer and as a stimulus to us, to our children and to our children's children to emulate Dr. Goddard's dogged determination to conquer the great frontier of space. On this date in 1926 he successfully launched the

world's first liquid-propelled rocket. Attached as appendix C is a brief history of Dr. Robert H. Goddard in support of this recommendation.

In summary, I recommend:

1. The expenditure of $4 billion more per year on missile and space activities.

2. The fostering of a climate of Government contracting that will encourage corporate incentive to do contract work for the Government.

3. The establishment of March 16 as Goddard Day.

Thank you for having invited me.

(The full text of Mr. Jackson's prepared statement is as follows:)

TESTIMONY OF NELSON P. JACKSON BEFORE THE COMMITTEE ON SCIENCE AND ASTRONAUTICS, U.S. HOUSE OF REPRESENTATIVES, FEBRUARY 23, 1960

I am Nelson P. Jackson of the Joy Manufacturing Co., a manufacturer of heavy equipment, whose products are used in missiles and on launchers, ground support equipment, aircraft and submarines, and in construction work.

My presence before you is in my role as president of the National Rocket Club, which organization is described in appendix A attached hereto. The invitation that I received from this committee, through Dr. Sheldon, asked me to testify on behalf of the National Rocket Club and, if unable to speak for the Rocket Club as a whole or for its directors, to testify as an individual.

Two weeks ago we took up your invitation with the club's committee for the then forthcoming National Missile/Space Conference. It was the consensus of opinion that, because of the divergent backgrounds, organizations and activities of our individual members who come from industry (large, medium, and small companies), from the press, and from the legislative and executive branches of our Federal Government, we would not be able to get together a statement setting forth the majority views of the membership in t e time available. It was agreed that the best that I could do would be to give you some thoughts expressed at the 1960 National Missile/Space Conference held here in Washington on February 16–17, and to add thereto my own ideas. We took up this suggested modus operandi at the annual meeting of the club on February 17, and the membership approved the above procedure.

The theme of this year's National Missile/Space Conference was the space challenge as it confronts the United States and the free world. Our objective was to promote policies, programs, and legislation necessary to establish and maintain United States space leadership, and to stimulate civil and military space programs for the benefit of mankind. There were four panel sessions of the conference, two luncheons, two receptions, and the Goddard dinner. The agenda for all of this is attached as appendix B.

The opinions of conference panelists varied from praise of our progress through 1959, to deploring our absence of competitiveness in space; from plugs for Saturn and Centaur booster programs, to urging the development of a nuclear-chemical rocket program; from using space as a colonizing medium for excess world population, to using it as a place for future wars; from urging acceptance of the status quo re NASA and DOD responsibilities in space, to plugging for more unification of our military and nonmilitary space programs; from using the Moon for colonization by excess people on the Earth, to using the Moon as a military base from which to control any area of the Earth; from our need to surpass Soviet achievements in space in order to recover our prestige throughout the world, to ignoring or belittling such Russian ascendancy; from a hesitancy to spend huge sums for space activities until our goals there are clear, to accepting and supporting $4 billion more per year that some think it will take to catch up with and overtake the Russians; from full international cooperation in space—through varying degrees of cooperation—to going it alone.

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There are doubts and hesitations about some of our national requirements in space—military, scientific, prestigewise. The proper resolution of these doubts could mean national and free world survival. With the stakes so potentially high but still somewhat unclear, I recommend the expenditure of an additional $4 billion per year for military and scientific all-out efforts in space. This would amount to less than 1 percent of our gross national product, only 6 percent of our total national budget, less than $25 per year per U.S. citizen—a bargain price for what could be survival.

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1. Tight procurement.
2. Audit piled on audit as (*a*) by a military service, (*b*) by the General Accounting Office, and (*c*) maybe by a renegotiation board.
3. Under National Aeronautics and Space Administration contracts, patentable ideas are the Government's and may not be used in commercial work.
4. Renegotiation.
5. Acquisition of proprietary technical data and know-how.

In competition with Russia over space, we will uncover new technologies in the carrying out of NASA contracts. Some of these technologies will have applications on Earth, but the Government will have all the rights to them—and we'll find ourselves backing into socialism.

I recommend the fostering of a climate of Government contracting whereby our corporate citizens, our industrial companies, will regain their incentive to serve our country.

Lastly, I recommend the establishment by Congress of March 16 as Goddard Day in honor of our great rocket pioneer and as a stimulus to us, to our children, and to our children's children to emulate Dr. Goddard's dogged determination to conquer the great frontier of space. On this date in 1926 he successfully launched the world's first liquid-propelled rocket. Attached as appendix C is a brief history of Dr. Robert H. Goddard in support of this recommendation.

In summary, I recommend:

1. The expenditure of $4 billion more per year on missile and space activities.
2. The fostering of a climate of Government contracting that will encourage corporate incentive to do contract work for the Government.
3. The establishment of March 16 as Goddard Day.

Thank you for having invited me.

Appendix A

The National Rocket Club

The National Rocket Club is the organization that sponsors the annual National Missile/Space Conference, which was held here in Washington on Tuesday and Wednesday of last week, February 16–17, and the Dr. Robert H. Goddard memorial dinner, which was held last Wednesday evening, February 17. The National Rocket Club was founded October 4, 1957, as an informal luncheon club for the exchange of ideas between people interested in rocketry.

The club was incorporated on March 31, 1958, as a nonprofit corporation under the laws of the District of Columbia. The objectives of the club are, to quote from the bylaws, "the advancement of guided missiles, rockets, and space flight for the benefit of the United States defense and scientific goals, and the maintenance on a nonprofit basis of a common meeting place in the National

Capital where, with a minimum of formality, representatives of all phases of rocketry may come to know each other. The club will, from time to time, provide suitable recognition and do honor to individuals and organizations who have contributed to the advancement of rocketry."

The club plays a role similar to that of the National Aviation Club as far as honoring people is concerned, similar to the Aero Club as far as sponsoring an annual dinner honoring America's first rocketeer, and the club stimulates other organizations and individuals to advace U.S. rocketry and astronautics.

The biggest need today for all segments of our population for the space age is education concerning rocketry and astronautics. The club aims to bring together personnel from Government, industry, Congress, the press, and others to exchange current nonclassified information on the subject, and through them to relay it to the public at large.

The club will stimulate the dissemination of unclassified information on rocketry or astronautics in the fields of the historical, educational, and business aspects of the missile business; will stay out of the technical aspects which are properly the province of the technical societies.

Rocket Club monthly luncheons have been held since its founding, and missile/space conferences and Goddard dinners have been held in 1958, 1959, and 1960.

Appendix B

The National Missile/Space Conference, February 16–17, 1960

PANELS

1. Space challenge—Philosophy

It was the aim of this panel to examine the philosophical parameters of the space challenge. What exactly is the nature of the challenge; what are its moral, ethical, religious, and legal implications? Is it necessary and desirable to establish footholds in space in the interest of defending the Nation and the free world? Does the national policy being evolved differ from currently stated U.S. policy?

Moderator of this panel was Dr. S. Fred Singer, professor of physics, University of Maryland.

Panelists were: Mr. Richard B. Canright, chief of research, missile and space systems engineering department, Douglas Aircraft Co.; Rear Adm. Thomas F. Connolly, Assistant Chief, Bureau of Naval Weapons, for Pacific Missile Range and Astronautics; the Honorable James G. Fulton, Pennsylvania, Committee on Science and Astronautics, House of Representatives; Mr. Bernard Haldane, career development specialist, Fairleigh Dickinson University; Mr. Ernest K. Lindley, bureau director, Newsweek magazine; Dr. Donald Michael, project coordinator, Brookings Institution: Dr. Leo Steg, manager, space sciences laboratory, General Electric Co.

2. Space challenge—Legislative aspects

The aim of this panel was to discuss the Nation's space legislative objectives. What new legislation is probable? What changes in present laws? What is the likelihood of international cooperation in the space field? And * * * is the U.S. space program apt to be a political issue in the coming national elections?

Moderator of this panel was Mr. Theodore F. Koop, vice president, Columbia Broadcasting Co.

Panelists were: The Honorable Victor S. Anfuso, New York, House Science and Astronautics Committee; Senator Thomas J. Dodd, Connecticut, Senate Space Committee; Dr. Franco Fiorio, United Nations (Italy); Mrs. Eilene Galloway, consultant, Senate Space Committee; Mr. Clarke Newlon, editor, Missiles & Rockets Magazine.

3. Space challenge—Outlook

This panel aimed to provide a recapitulation of where we are and where we are going, to catalog our accomplishments and our deficiencies to date and project the integrated national program for the exploration and exploitation of space which is required in the years ahead, and give a summary of specific programs and projects.

Moderator for this panel was Mr. Kurt Stehling, Aeronautical Research Scientist (Rocket Propulsion), National Aeronautics and Space Administration.

Panelists were: Spencer M. Beresford, Esq., special counsel, Committee on Science and Astronautics, House of Representatives, Mr. Norman L. Baker, publisher and editor, Space Business Daily, Dr. Vincent Cushing, president, Applied Sciences, Inc., Mr. Martin Decker, president, the Decker Corp., Brig. Gen. Donald D. Flickinger, USAF, Assistant for Bio Astronautics and Surgeon, Headquarters, Air Research and Development Command, Dr. Dorothy Simon, technical assistant to the president, Research and Advanced Development Division, Avco Corp., Dr. Homer Joe Stewart, Director of Program Planning and Evaluation, National Aeronautics and Space Administration.

4. Space challenge—Marketing

American industry contributes enormously to the missile-space business; will be asked in the future for much more help. Will industry continue on the planning as well as the hardware team? On prime as well as sub contracts? Or is the Government going to do its own planning and be its own prime contractor? Under whatever rules are in the making, what will be the marketing problems in selling to the Government? To prime contractors?

Moderator for this panel was Lt. Gen. Mark E. Bradley, Jr., USAF, Deputy Chief of Staff, Materiel, Headquarters, U.S. Air Force.

Panelists were: Mr. L. E. Tollefson, Washington representative, Douglas Aircraft Co., Inc., Mr. Karel Jan Bossart, assistant to the vice president of engineering, Convair Division, General Dynamics Corp., Mr. Ernest W. Brackett, Director, Procurement and Supply Division, National Aeronautics and Space Administration, Mr. J. W. Crosby, president, Thiokol Chemical Corp., Dr. Robert B. Dillaway, manager, Nucleonics, Rocketdyne Division, North American Aviation, Inc., Mr. R. R. Kearton, assistant general manager, Missiles and Space Division, Lockheed Aircraft Corp., Mr. Donald E. Perry, managing editor, Missiles & Rockets Magazine, Mr. N. I. Schafler, president, Consolidated Diesel Electric Corp., Mr. Ernest G. Stout, manager, Washington Operations, the Ralph M. Parsons Co.

LUNCHEONS

The speaker at the Space Age Luncheon was Mr. Krafft A. Ehricke, assistant to the technical director, Convair Astronautics Division, General Dynamics Corp.

Speaker for the Missile/Space Industry Luncheon was Dr. Arthur R. Kantrowitz, vice president and director, Avco Corp.

DINNER

The speaker for the Dr. Robert H. Goddard memorial dinner was Lt. Gen. Bernard A. Schriever, commanding general, Air Research and Development Command, USAF.

Appendix C

Dr. Robert H. Goddard

Dr. Robert H. Goddard, the world's pioneer in rocketry, is now often called the Wilbur Wright of the missile and space age. Born in 1882 in Worcester, Mass., Dr. Goddard attended Worcester Polytechnic Institute and received his M.A. and Ph. D. from Clark University. He was a research fellow in physics at Princeton University for 2 years and later joined the faculty of Clark University where he became a full professor in 1919.

At a very early age Dr. Goddard became interested in rockets and by 1912 had worked out the detailed mathematical theory of rocket propulsion. In 1914 he obtained two U.S. patents upon which today's rocketry is still based. He was the first to develop the use of liquid fuels in rocketry, the first to develop gyrosteering apparatus for rockets and the first to explore mathematically the practicality of using rocket power to reach the moon.

His efforts were largely ignored throughout the United States although he was granted $5,000 by the Smithsonian Institution to carry on his experiments. His talents applied this grant to the development of the bazooka rocket 15 years before it was finally recognized and put into service during World War II. While his work received little attention here, in Europe foreign powers took Dr. Goddard very seriously indeed. They studied the results of his experiment in detail and applied them to the development of the German V–2.

Dr. Goddard persistently carried on his experiments. On March 16, 1926, he successfully launched the world's first liquid-propelled rocket. This and other more successful firings still were unfavorably received until they were brought to the attention of Daniel Guggenheim, who in 1930 granted him $25,000, making possible the first large-scale rocket experiments in the United States.

By 1935 Goddard's rockets had reached a weight of 85 pounds, 18 feet in length and soared 7,500 feet at 700 miles an hour.

He suspected the Germans of following a similar program and for several years urged the War Department to take an interest in the rocket as a weapon. Finally in 1941, the Navy began to show some interest in his work and Dr. Goddard patriotically volunteered his services to the Nation's war effort and until his death in 1945, worked on jet-assisted takeoff rockets and glide bombs.

Had Dr. Goddard lived to see today's effort in the missile and space industry, he would surely have seen his life dream becoming a reality.

His enormous work of bringing to practical realization the possibilities of rocket and space flight, will forever be recognized as the most important technical achievements of these times, marking a turning point in the history of mankind.

APPENDIX D

OFFICERS AND DIRECTORS OF THE NATIONAL ROCKET CLUB, WASHINGTON, D.C.

President: Nelson P. Jackson
First vice president: C. Lincoln Jewett
Second vice president: Robert D. Ladd
Secretary: Rooney E. Wilson
Assistant secretary: Daniel T. Garges
Treasurer: Richard A. Carpenter
Counsel: Bernard J. Gallagher
Governors:
Ralph M. Anglea
Norman L. Baker
Barney Capehart
Hon. H. R. Collier
Dr. William Cooley
James J. Fisher
Governors—continued
George C. Gilman
Peter S. Hackes
Vern Haugland
Herbert F. Hodge
Senator Henry M. Jackson
Ben S. Lee
A. S. Mrozek
Donald E. Perry
Charles M. Poll
Col. H. W. C. Shelton
Warren R. Smith
H. A. Timken, Jr.
Joseph R. Trueblood

The CHAIRMAN. Thank you very much, Mr. Jackson. That also is a very fine statement.

Mr. WOLF. Mr. Chairman, did he mean "cooperative" or "corporate"? There is quite a difference there. In point 2 in his summary.

Mr. JACKSON. Encourage corporate incentive to do contract work. Thank you for the correction.

The CHAIRMAN. That, too, is a very fine statement.

Now, gentlemen, there are complete statements prepared by these gentlemen and I think in fairness to them that we ought to have those incorporated in the record. So if there is no objection——

Mr. FULTON. I so move.

The CHAIRMAN. All of those statements will be incorporated in the record.

(The statements referred to are placed in the record in conjunction with the oral presentations.)

The CHAIRMAN. Mr. Jackson, I want to ask you this: I want to first state that I am thoroughly in sympathy with the establishment of Goddard Day. I think that ought to be attended to, as proper recognition of a man who did pioneer space.

In reference to your suggestion about $4 million additional expenditure, I want to ask you this: Do you mean $4 million——

Mr. ANFUSO. Billion.

The CHAIRMAN. $4 billion over and above what is presently planned or do you mean—what sum total do you mean?

Mr. JACKSON. $4 billion over and above what is presently planned.

The CHAIRMAN. What would that make as a total for expenditures of Government for space?

Mr. JACKSON. I don't have that figure, sir.

The CHAIRMAN. But whatever that is—are you familiar with the plans for the future, expanding plans on space?

Mr. JACKSON. Not if they are classified; no, sir. Only what I have read in the papers.

The CHAIRMAN. At any rate, that clears up the idea I had in mind.

Mr. JACKSON. I did not, if you will notice, sir, I did not suggest a division of that expenditure between the military and NASA. I thought that the executive branch of the Government and the Congress in their wisdom could figure out how this could be done.

The CHAIRMAN. I want to ask you this then: Do you think we can successfully divide military space from peacetime space?

Mr. JACKSON. That is the $64 question.

The CHAIRMAN. I am going to ask every other one on the panel the same question.

Mr. JACKSON. Traditionally plowshares have followed swords. Maybe for once in history we might reverse this, if we put enough money into NASA, and thereby and thereafter have the swords following the plowshares.

I think there are unknowns in space that money has to be spent on now, vis-a-vis, the Russians. We don't know why they are doing what they are doing, but they are sure busy at it. [Laughter.]

And, if we don't at least try to keep up, we may find ourselves lacking things that can be developed through NASA that could be used by the military.

The CHAIRMAN. Dr. Seifert, do you have any statement in reference to that question?

Dr. SEIFERT. I would just like to quote the last sentence of my prepared statement, which says:

> We hold that we must not force an artificial separation between the scientific and military potential of space and that we must be fully aware of the possible military aspects of space if we are to assure ourselves of an opportunity to explore space peacefully.

I think they must go hand in hand.

The CHAIRMAN. Together?

Dr. SEIFERT. Yes.

The CHAIRMAN. They can't be entirely separated?

Dr. SEIFERT. Right.

The CHAIRMAN. What about you, Dr. Arthur?

Dr. ARTHUR. I would also like to quote from our statement. We take no position as to whether the military or the civilian should control space.

The CHAIRMAN. I am not asking that question.

Dr. ARTHUR. But we do feel that it is a mutual problem; there cannot be a separation.

The CHAIRMAN. Do you believe that peacetime use of space and military use of space can't be divided?

Dr. ARTHUR. Not too well. I think it would be artificial. There is a common technology.

The CHAIRMAN. And what about Dr. Stever?

Dr. STEVER. The institute has no position on this at all, although the individual members take each of the three positions, three possible positions, and take them very strongly. Personally I believe that the associated sciences and technology are quite similar in both military space and nonmilitary space.

The objectives are somewhat different. Again I think that there are important objectives in both fields.

The CHAIRMAN. The objectives are different but the development of the rules, for instance, under which you operate, the laws of nature which you discover and utilize are adaptable either to military or nonmilitary; is that it?

Dr. STEVER. I think that is right.

The CHAIRMAN. Mr. Fulton.

Mr. FULTON. We are glad to have you here. I believe the statements are both interesting and informative.

Of course, the question comes up when the Congress has unanimously said that the U.S. policy will be to proceed into space by peaceful means for peaceful purposes, shall we change that basic policy?

The second great question is when the United Nations has unanimously in General Assembly set up a committee for the peaceful uses of space, shall we in the United States go directly contrary to that and make ourselves a military entry for a military purpose, ending up as we did in past history when we had the sea on this basis in the days of the Spanish Armada for crucial control in that particular area. Now, my question is this: If our Government military programs are for weaponry systems and too often there is little room in those programs for basic science, I am surprised that you scientists are not pleading for room for pure science and for exploration and for the use of a medium for its best purposes for the benefit of not only this country but mankind.

The second thing is this: Historically NACA—National Advisory Committee for Aeronautics—was very successful as a civilian organization moving right alongside with the military applications of planes. But, of course, planes were used for both purposes.

Nobody said to put the manufacture of all planes under the military and the exploration of all atmospheric space under the military. They knew better.

Now, the question comes up: Does any one of you think the method of NACA was wrong and therefore we should at a certain point in time and in altitude from the center of the Earth say that we will not base a national aeronautics and space agency on NACA, but we will change it and put it all over under the military?

Does any one of you say that?

Mr. JACKSON. No, sir.

Mr. FULTON. Would you each reply for the record without nodding your head?

Dr. SEIFERT. No, sir.

Dr. ARTHUR. No.

Dr. STEVER. No.

Mr. JACKSON. No.

Mr. FULTON. The two greatest space programs have been the Russian and the United States and right from the beginning it has been the Academy of Science of Russia, with a scientist at the head of it, president of it, and a scientist at the head of the Interplanetary Commission that ran it, and have done it pretty successfully.

Do you think that was wrong of the Russians to do that? They have had quite a mixture, I must say, down below, generals, admirals, corporals, and scientists, mixed them all up together, but at the head of it there was a scientist.

I think it was about 1926 when it was decentralized and moved off into institutes with a broad base.

Would you please again reply, each of you? Was that right or wrong in view of the results of the Russian programs in space? Just say "Yes" or "No" and move on.

Mr. JACKSON. No comment.

Mr. FULTON. Next.

Dr. STEVER. May I—

Mr. FULTON. These Russians are human beings. They are scientists and they are military people just like we are. Whether we——

The CHAIRMAN. Strike out "just like we are" and then I would agree with you.

Mr. FULTON. I mean that. Whether we agree with their form of politics or not, we disagree with their politics; but again I emphasize they are human beings just as we are, because I have had a Russian brother-in-law and I am a great admirer of the Russian people, so I will refuse to strike that one out.

The CHAIRMAN. The gentleman can use his own judgment. I am not going to insist on it, but I simply don't want to be associated with being just like the Russians. I don't think we are.

Mr. FULTON. Don't you think you are a human being just as the Russians are?

The CHAIRMAN. Oh, yes, I am a human to that extent.

Mr. FULTON. That is the least common denominator of existence.

Mr. WOLF. Would the gentleman yield to me?

Mr. FULTON. Yes.

Mr. WOLF. I don't think they can answer this question with a "Yes" or "No" answer. I would hate to bind them with that kind of an answer.

Mr. FULTON. Let them put it in the record later. Since it is already set up by the order of the President that we shall have a National Aeronautics and Space Administration to come up with scientific and peacetime answers, to change from that, putting it all under military and therefore having the emphasis of the Federal Government on weapons systems with little room for pure science, the question then arises: Shall we now make the change?

Would you please answer that one "Yes" or "No"?

Mr. JACKSON. I don't think we should make the change, no.

Mr. FULTON. All right. Next one.

Dr. STEVER. May I add a little to just a "Yes" or "No" statement?

Mr. FULTON. All right. My time has expired.

The CHAIRMAN. Sure is.

Mr. FULTON. Oh, no, 6 minutes have.

Dr. STEVER. It seems to me that we have been making military and scientific people as different people. In all of our experiences in the Institute of the Aeronautical Sciences they appear to be the same people, possibly in different suits. In our scientific and engineering forums we find that military scientists, scientists who are working for the Government in military organizations, are high quality and can stand up with others. In fact, many of these change their hats from time to time in their lifetime.

Mr. FULTON. Would you make the statement for the record for us? I don't want to go over my time. Would you do that for us?

Dr. STEVER. Yes, sir. Certainly.

Mr. FULTON. Next man.

Dr. ARTHUR. Our position was that we take no position as to whether it should all be under the military or under the civilian.

Mr. FULTON. Should it be changed now?

Dr. ARTHUR. No, we take no position on this.

Mr. FULTON. Would you submit, each of you, for the record, and give it some thought?

Dr. ARTHUR. But we do feel it is a mutual problem, military and civilian.

(Dr. Arthur's further statement is as follows:)

FURTHER COMMENTS OF G. R. ARTHUR, ON CIVILIAN VERSUS MILITARY CONTROL OF SPACE PROGRAMS

As noted in the testimony this is a mutual problem. The comparison of NASA with NACA is not a valid one since NASA is much more involved in applications than NACA ever was. The military is perfectly capable of pursuing peaceful scientific programs in areas which may have military overtones. Antarctic exploration for example is a clear case in point. The Navy has had the facilities and has done much valuable work there. The same situation exists for space. The military resources for exploration are great and must be utilized. In most application areas the military is probably best suited to pursue the program under civilian check and balance.

The NASA strong suit is research and early development as was done in NACA days. It would appear that with firm leadership and a thought-out plan, NASA in research and the military in applications could advance our space efforts in concert. All we need is some clarification of charter areas and then an enforcement of this by strong, dedicated leaderships, leadership which wants the United States at the top.

Mr. FULTON. I want to compliment Dr. Stever on the statement that the speed is to be calculated from zero to infinity rather than from zero to the speed of light.

The CHAIRMAN. May I say to the gentleman, we don't want to rush anyone unduly in reference to the supplementing of these statements as has been suggested here. However, we would like to have those statements very soon. Some of our records, I am told by the staff, have been held up for weeks because we are not able to get these statements that were supposed to be submitted for the record.

To that extent in the future we are going to have to be a little bit more careful about holding the record open.

Mr. Miller?

Mr. MILLER. How much time do we get; 5 minutes?

The CHAIRMAN. Five minutes; yes.

Mr. MILLER. Dr. Arthur, I was struck by something you said on page 2 of your statement that although there had been some advanced

planning in the program at the present time in the manned satellite field, it is felt that the lack of strong support for a substantial follow-on program to Project Mercury is a definite gap.

Would you expand that a little bit, please?

Dr. ARTHUR. Yes. There are many areas in the manned field which do not seem to be covered in the present programs. Among these are more intensive work on closed life systems which are going to be necessary to support the man for a length of time longer than a few days. In addition, work in the rendezvous and satellite ferry area doesn't seem to have been covered in the planning to any great degree. These are areas which actually are vital to any long-term manned program.

Mr. MILLER. You think we should be doing more in those fields now?

Dr. ARTHUR. Yes, sir.

Mr. MILLER. We have practically done nothing in them to date?

Dr. ARTHUR. Only study work by various companies has been done in rendezvous to my knowledge.

Mr. MILLER. That is all, Mr. Chairman.

The CHAIRMAN. Mr. Van Pelt.

Mr. VAN PELT. No questions.

The CHAIRMAN. Mr. Anfuso.

Mr. ANFUSO. Gentlemen, I first of all want to congratulate each and every one of you for the very fine statements you have made.

Would you agree with this statement that we cannot help but recognize the fact that the military aspects are interwoven with the peaceful uses of outer space, and they are inseparable and certainly the Russians recognize that fact and whatever research they are making they intend to use both militarily and for peaceful purposes?

But would you say that while we can't help but recognize that existing fact that our goal, our goal nevertheless, the goal is for the exploration of outer space for peaceful purposes and if military results are derived therefrom, of course, we must utilize those things, but our goal should always be the peaceful exploration of outer space for the benefit of mankind?

Would you agree with that statement?

Mr. JACKSON. I agree with that.

Mr. ANFUSO. Would you, sir?

Dr. STEVER. I believe that there is a peaceful goal in space and there is a military one and if there were no peaceful one there would still be a military one left, and vice versa.

Dr. ARTHUR. I agree, sir, that the peaceful goal is a vital one. I think, however, we can't overlook the military implications.

Dr. STEVER. I agree.

Dr. SEIFERT. I think the peaceful one is the one we would like idealistically to have, but the other one is thrust upon us.

Mr. ANFUSO. Now, gentlemen, Russia graduated something like 93,000 scientists last year, and I think you will all agree that we could very well speed up our efforts to encourage young men to go into this field. I think all of you have partially covered that in your statements.

Do you think that perhaps the creation of an institution, of an academy for these young men who can't afford a college education, but supposing we had something on the order of the Military Acad-

emy at West Point or Annapolis, or the Air Force Academy at Colorado Springs; suppose we had one that restricted itself solely to creating scientists, giving these young men an opportunity, those who are interested, giving them an opportunity to take up science, for the Government to encourage them, to provide a proper academy for research and learning in that field, to provide the proper instructors, don't you think that that would be a good thing for the country?

Mr. JACKSON. No, sir, I don't, Mr. Anfuso. When West Point was founded in 1802—and I graduated from West Point—there was no place other than Rensselaer for the Government to send young men for a technical education.

Mr. MILLER. As an engineering school?

Mr. JACKSON. As an engineering school.

Mr. MILLER. That is right.

Mr. JACKSON. I wrote a paper a number of years ago, about 15, recommending that the then existing academies, West Point and Annapolis, and a possible future Air Force Academy, should become postgraduate institutions because in this century we have literally hundreds of educational institutions where boys can go to get undergraduate engineering educations, and for this reason I don't think we need a special college to do this. I would recommend Government aid to existing institutions to educate potential engineers who couldn't otherwise get such an education.

Mr. ANFUSO. Will you allow me a minute, Mr. Jackson? Wouldn't you say that the Air Force has already contributed a great number of engineers and has helped the effort? We have created an undergraduate Air Force Academy even though you opposed it.

Mr. JACKSON. Yes, this we have done.

Mr. ANFUSO. Don't you think an additional academy would help? After all, do we have enough colleges and do we have equal opportunity for all young men who want to take up science courses at this moment? I don't think we have.

If you wish to submit something further on that, Mr. Jackson, I certainly would like to have it, because I have a bill in that respect.

Dr. Seifert.

Dr. SEIFERT. I am inclined to favor all support toward education, although on reflection if you say that you want to produce scientists, this sounds like a graduate school rather than an undergraduate school. One doesn't usually label them scientists until some years after graduation from the ordinary undergraduate college.

Mr. ANFUSO. I mean, do you favor the creation of an academy that would bring about more scientists after a proper examination is given to them, of course, to qualify?

Dr. SEIFERT. I think I would favor the creation of something you might call a graduate academy.

Mr. ANFUSO. Graduate academy; all right.

Next one.

Dr. ARTHUR. I don't feel I can formulate an opinion on the academy. I do feel that further encouragement and shoring up of all of our existing institutions and an encouragement of science and engineering as a profession would be a step in the right direction.

Mr. ANFUSO. All right.

Dr. STEVER. Mr. Anfuso, I think the objectives, the two objectives you stated can be achieved in other ways and possibly more effective ways. Those two objectives are: Giving opportunities for young men who couldn't afford college—that can be achieved in other ways; and expanding the total facilities for science and engineering education—that also can be achieved in other ways, and possibly more effectively.

The CHAIRMAN. Mr. Riehlman?

Mr. RIEHLMAN. Mr. Chairman, I have enjoyed the statements made by these four distinguished gentlemen here this morning. I am sure they are all familiar—they are all interested in our exploration in space because of their statements. But I am wondering if they have taken a look at the recent program that NASA has presented to cover a period of 10 years and what your feeling is in respect to it, what we can accomplish under that program.

I would ask all of you to comment on that if you would, if you are familiar with the 10-year program presented to this committee by NASA for the exploration of space and with the end of the program, the landing of a man on the Moon.

Dr. SEIFERT. My feeling about this is that I would indeed approve such a program for the first 10 years. I was talking about things which might go longer than 10 years, might go 25 years in extent. But this seems like a very suitable program if it is indeed implemented consistently.

Mr. RIEHLMAN. All right. Dr. Arthur?

Dr. ARTHUR. I think the NASA program is an excellent one. The feeling which was reflected in our statement was that perhaps it could be a little bolder and a little more intensive, especially in the manned area. I think the scientific exploration aspects of the NASA program are really topnotch.

Mr. RIEHLMAN. All right.

Dr. STEVER. Personally, I think it is a fine program.

Mr. JACKSON. And I think if it had a little more in it in the way of money it should go a little faster.

Mr. RIEHLMAN. You made an interesting statement that you would like to see $4 billion additional expended in the field of the exploration of space and in our missile program. Have you given any serious study as to how that would be allocated or is that a figure just arrived at without serious consideration as to how you could economically and constructively spend $4 billion additional a year?

Mr. JACKSON. This figure came from one of the panelists at the missile/space conference last week, and I did not go into detail with him into the basis of it, but he comes from a substantial establishment that I am sure helped him in the research of it.

Mr. RIEHLMAN. This is one man's opinion; is that correct?

Mr. JACKSON. Yes.

Mr. RIEHLMAN. Or is this the opinion of your whole group?

Mr. JACKSON. No; this is one man's opinion.

Mr. RIEHLMAN. I see.

Mr. JACKSON. Which I adopt as my individual opinion, sir.

I think that this sum of money split between the Department of Defense and its various services, and NASA, would help us along with the program where we might not get caught short here a few years hence.

I think this is the difference as was expressed last week between what Russians are doing and what we are doing.

Mr. RIEHLMAN. That is the only question I have, Mr. Chairman.

The CHAIRMAN. Mr. Sisk.

Mr. SISK. Dr. Seifert, I would like to ask you to comment on two or three things in your statement. I think, by the way, all of your statements are good, gentlemen.

You say, on the bottom of page 5, in your statement, that once we have defined our aims for the space program we shall be able to establish a series of logical steps and so on and so forth.

Now, do you feel that there are lacking some definite decisions or aims at the present time and that we probably should outline more definitely where we are going or where we hope to go and what our exact aims are?

Now, I am going to later refer you to page 7 regarding technical goals also, and to some extent, I think they are joined. At least my question that I have in mind joins them here with reference to setting up distinct goals and definite aims in this program.

Now, I wonder if you would elaborate a little bit further on just where you think we stand as a nation today with reference to whether or not we have defined goals and definite aims?

Dr. SEIFERT. I think we are just crystallizing these aims. The NASA 10-year plan is one example of such definite goals. I think we are sort of in the midst of jelling this program. This sounds like a criticism here, but actually it is a statement of an ideal which we may indeed be implementing. I am not so familiar with the details of the program that I know exactly how well all this is being carried out.

I feel that there should be something like a system study of the whole problem and a selection of a finite number of goals and this may indeed be in process of being carried out with my not being informed within the last few weeks of it.

Mr. SISK. Of course, I have been somewhat critical of an attitude in NASA about the lack of certain specific goals, or at least the lack of concentrating on certain specific goals. I notice on page 7 under your technical goals you mention something that I have been personally very much concerned with, and this was making an all-out maximum effort on so-called superboosters, with the idea of the earliest manned exploration to the Moon as being the most feasible, immediate goal.

In view of the fact that you actually seem to be going in that direction, I was just curious to know if you do feel that is a goal that we possibly could work for a little harder than we are doing at the present time.

Dr. SEIFERT. I am speaking without enough staff work here to have a very firm conviction, because when you recommend a particular program it should be done only on the basis of a rather extensive study, and this document was written as a collection of opinions solicted from the board of directors.

However, individually, my feeling is that the effort on the very large scale boosters could indeed have some more emphasis on it. It may turn out that money cannot be spent at a rate very much greater than it is at present, but my personal feeling is that such an attempt should be made.

Mr. Sisk. We realize, of course, there is a limitation on how rapidly money can be spent. Of course, just to pour money out doesn't do any good unless we have all the other things to go with it in the way of know-how, people, the human side of the equation.

However, I have been of the opinion, certainly, and that is why I wanted to explore it with you, that we should, seemingly, at this late date, have made a definite decision here with respect to what our goal is.

Now, certainly the immediate goal—apparently No. 1—DX priority by NASA is to put a man in space. But the logical next step is: What are you going to use the man for? which would seem to me to indicate that we should more firmly have our eye fixed on that goal of exploration of the Moon or else, if you are going to skip the Moon, let's go on somewhere else.

I don't think we should skip it: I think this should be it. That is the point I was attempting to see just how strongly your people felt on this issue.

Dr. Seifert. I think I must beg off on the manned missions beyond Mercury, because of a lack of considering it carefully. This is such an expensive program that ordinarily in industry one would not even venture an opinion on it without a long study. On that particular one I think, "No comment, beyond approving the present program."

The Chairman. Mr. Wolf.

Mr. Wolf. Thank you, Mr. Chairman.

Mr. Jackson, I was intrigued by your comment on page 2 that our Government procurement system has thus become so distorted over the last few year that we are destroying incentive. This is in the 5th paragraph. Of course, I am sure you are aware that the complicated procurement system was brought on by the disclosures many times of too great profits on the part of industry.

Mr. Jackson. Yes, sir.

Mr. Wolf. And almost a greed.

Like everyone else, where I am concerned about the fact that it is a complicated procedure and I don't want to take part of my limited 5 minutes to discuss with you what we can do, but I am sure that you wouldn't have said this if you didn't have some ideas on how we could improve it.

I don't think you developed them as much as you could, and I would be grateful if you would, for the record, put something in the record on this, developing these ideas. If you have a quick comment or two you would like to make at this time, I would appreciate it.

Mr. Jackson. As you know, sir, management was guilty of abuses and then unions grew and became powerful and then they became guilty of abuses. Maybe management was guilty of too high profits a while back. I believe that we are squeezing the rubber ball now and it is bulging out in the area were people say to me: Gee, if I have a choice between selling to somebody in commerce or selling to Government, I will sell to commerce any time.

This is felt and thought today—an openly stated idea—by many people in business, who have to do business with the Government or whose products are salable to the Government. This I don't think is healthy. What I am going to say is just general, sir, without being too specific——

Mr. WOLF. Would you get specific in a report that you would place in the record at this point?

Mr. JACKSON. I would prefer to work——

Mr. WOLF. After thinking it through a little while.

Mr. JACKSON. I would prefer to work that up and send it in.

Mr. WOLF. Yes. He only gives me 5 minutes, my fine chairman, so we couldn't get into this in detail.

Mr. JACKSON. I will be glad to send that in.

The CHAIRMAN. Do that in the next few days.

Mr. JACKSON. Yes, sir.

(The statement referred to follows:)

SUPPLEMENT TO STATEMENT AND ORAL TESTIMONY OF NELSON P. JACKSON

During the course of my testimony before the committee, I cited certain practices that seem to me, on the basis of my experience in private industry, to destroy or hinder the incentive of manufacturing companies to devote a part of their total output to the needs of national defense. Because of the existence of these factors, we find that a number of prominent executives of some of these companies which have played a very great role in defense procurement through World War II, the Korean war, and the post-Korean emergency, have privately voiced a reluctance to do business with defense establishments and a desire to devote all of their business to commercial customers because of these disincentive features which I mentioned. This feeling of dissatisfaction with present Defense Department procurement policies and procedures is clearly relevant to this committee because Dr. Glennan has made it clear that, generally speaking, NASA will follow the procurement practices and policies of the Defense Department.

Congressman Leonard G. Wolf has requested that I offer suggestions as to how contractor incentives might be increased. This is rather a large order to undertake in so short a time. However, the elimination of the disincentive features, referred to in my testimony, would certainly improve the atmosphere considerably.

The first point I mentioned was tight procurement. There seems little doubt that present DOD procurement policies tend to encourage military contracting officers to place almost complete emphasis on low cost to the exclusion of the considerations of quality, technical competence, and ability to furnish spare and replacement parts, in both formally advertised and negotiated procurement. ASPR regulations require that awards be made to the low, competent, and qualified bidder, but in the few instances where the military services have attempted to give due consideration to quality factors, the General Accounting Office has apparently decided that this is contrary to the intention of the competitive bid statutes. Another example of tight procurement is the inordinately low fixed fee prescribed by ASPR for CPFF contracts.

The 10 percent fee limitation for CPFF supply contracts established by statute has, for example, been administratively lowered to 7 percent by section III of the procurement regulation.

Secondly, I mentioned audit piled on audit. All contracts with the military services are subject to renegotiation. The renegotiation process normally entails the furnishing of detail cost data to the Renegotiation Board. In many cases, the sources for such detailed cost data are subject to audit by the Renegotiation Board personnel. Moreover, all negotiated contracts, even those awarded under firm fixed prices, are subject by statute to postcontract audit from the General Accounting Office. Finally, the military services frequently use rather detailed contract clauses to provide themselves with extensive audit authority. In this connection, it should not be overlooked that the Defense Establishment apparently has nearly a complete audit cognizance of all types of contracts, under the Second War Powers Act.

It certainly seems to me that there is no need to audit the books and records of contractors doing business with the Government under formal advertising. Even in those instances where a case can be made out for Government audit, for example in cost-reimbursement contracting, it seems to me one audit would suffice. It should not be overlooked that such Government audits cost companies

a great deal, in terms of tying up manpower and facilities over a long period of time.

In the third place, I mentioned the patent provisions of the Space Act. It hardly seems necessary for me to repeat what has been so forcefully brought to this committee's attention during the hearings on NASA patent policies which took place before this committee last December. I might just recap briefly, however. The Space Act gives authority to the Administrator to take title, under certain conditions, to inventions occurring during the performance of a research and development contract or subcontract with NASA. Thus, when a contractor enters into such work for the Space Administration, he has no knowledge as to whether he will be allowed to obtain patents on inventions occurring during the performance of such contract work. At the very least, the committee should consider ways and means of providing such certainty to contractors. You will recall that Mr. Johnson, the General Counsel of NASA, specifically mentioned the adverse effect of the Space Act patent policy on getting people to do contract work for the Space Administration.

Fourthly, we come to renegotiation. Everyone seems to recognize the fact that contracts with firm fixed-price provisions offer the maximum incentive for prompt and efficient performance of Government contracts. Competitive bidding has always been thought to have the built-in feature maximizing contractor efficiency and holding out the reward of a sound profit for good performance. Why should such a profit figure, computed as a part of the contractor's original bid, be subjected to second-guessing by the Renegotiation Board or by anyone else?

There have, I recognize, been many allegations about exorbitant profits on the part of defense contractors. Without trying to discuss the merits of such complaints, I note that there have been no such allegations regarding contractors doing business with the Government under formal advertising. Accordingly, I can see no argument for continuing renegotiation in this area.

The fifth point I mentioned concerned present policies regarding the acquisition of proprietary technical data and know-how. The present ASPR regulations provide that the Government may acquire proprietary technical data under supply contracts only upon payment for such data. However, it is becoming increasingly clear that the military services in many cases refuse to recognize that a contractor's detailed manufacturing drawings are proprietary to that company. Regardless of whether such drawings are what the Government lawyers call proprietary data, there is no question that such drawings embody the fruits of many years of research and development and the spending of large amounts of money by private companies.

The Government does not attempt to acquire title to private patents resulting from research performed by a company at its own expense. I can see no reason why the Government does not follow a similar policy with respect to the nonpatented fruits of a company's own research program. I suggest that recognition of a contractor's proprietary rights in the results of his own research and development program will have a significant incentive in the willingness of many manufacturing companies to bid on procurements for standard-type items with only slight military modifications.

There are some instances, and this situation is growing, where private firms are investing large sums of their own in development work and are contributing proprietary knowledge developed by the company prior to acceptance of the Government contract. Quite often individual firms are asked to give up existing proprietary rights on previous work as a condition to obtaining contracts. In these and similar instances, the equities of the situation should be weighed carefully by contracting offices to insure that legitimate proprietary interests are taken into account. This is an important factor in eliciting a maximum contribution from the industry.

Mr. WOLF. I would like to congratulate Dr. Arthur on his statement. I think the most significant point in your whole statement from my point of view is—

If the elementary schools are not supplying the firm foundation so necessary for future success the house will surely crumble under the future stresses we know will occur.

I want to congratulate you for this statement.

I would like to ask if we can get into this area sometime in the future, would you be willing to come back and develop this theory a little bit more?

Dr. ARTHUR. Yes, sir; I would. I am working locally in my own residential area in this problem which I feel very strongly about. I found general agreement among the board of the society that this indeed was a problem. I should indeed be most happy.

Mr. WOLF. I am wondering if you might have some ideas offhand at the moment, or you can supply to us, of some other folks who might help us with this area?

Dr. ARTHUR. I should be glad to send you some information on this.

Mr. WOLF. I also notice your comment: "This potential is constantly being diminished by our conservative approach," for which I congratulate you.

I don't want to put you on a spot, but I wonder if you favor either of the Federal aid to education bills. One has already been voted on in the Senate and we are hoping to get one up in the House.

Dr. ARTHUR. I think, speaking for the society, I don't think I can take a position on this.

Mr. WOLF. All right. If you would like to speak for yourself.

Dr. ARTHUR. Speaking for myself, I think that Federal aid to education is a real problem. I think the real help that Federal can make is in the physical area, physical plant, and so forth. Our educational system is such that it is still handled on a local basis. The only Federal aid here would be, I think, in terms of information and a greater education so to speak of local school boards as to the needs of the country in this area.

Mr. WOLF. I would be happy to have you come back, I am sure, for myself. I don't think I can speak for the committee on this.

I hope we can develop this area, Mr. Chariman. I want to congratulate these gentlemen for their provocative statements.

The CHAIRMAN. Thank you. Mr. Daddario?

Mr. DADDARIO. Dr. Stever, in your statement you referred to the United States having the responsibility for world leadership and you also say the technical potential of this country is strong enough to meet any challenge. Do you think in the field of space that we haven't properly utilized our technical potential to be in a condition of world leadership that we should?

Dr. STEVER. As far as utilizing our talent with respect to giving them jobs to do and providing the proper backing, I think the contracts and the programs that have been laid out are very good in that respect. Our statement was pointed to the fact that essentially we wanted to get on the record that we have greater capability than we are using.

We didn't comment on the level of support, and I think this is the main job of this committee and the Congress to do, to get the level at which we in this country should support this effort. We are sure that if it is supported to a greater degree, the scientific and the engineering talent can be found. We have it.

Mr. DADDARIO. Then getting back to the spending of more money or to the pushing faster of these programs which we have, it is your opinion, then, that we are not using our full potentials and that we

have the people who could be utilized in order to push this whole program ahead?

Dr. STEVER. Yes.

Mr. DADDARIO. And you also say that we have the great capability for emergency expansion. Now taking the speed with which an emergency could come upon us, don't you believe that actually the emergency in the space area is now rather than after something has been accomplished?

Dr. STEVER. Yes, sir. I think you are referring to a time lag or a buildup period. There certainly is a buildup period and we know from experience in World War II that this was of the order of a small number of years to bring our strength up to maximum size.

However, at the present time I suspect we could marshal strength in this field at a more rapid pace because there are people who are trained in this program who are not being fully utilized in the program.

Mr. DADDARIO. Well, do you believe that we could and should prepare some kind of a program with the skills of these scientists properly cataloged and with some kind of a schedule set up so that there wouldn't be any organization problem, to use them in the event of an emergency, but so that this work could be done ahead of time? And if you believe so, do you think there is anything that exists now that could be quickly packaged in such a manner so that it could be used?

Dr. STEVER. I would like Mr. Daddario to make very clear that the Institute of the Aeronautical Sciences takes no position on this subject at all. So what I would say would be my personal feeling.

Mr. DADDARIO. Yes.

Dr. STEVER. Among my colleagues in the Institute of the Aeronautical Sciences, I think I would be considered an enthusiast for this space program and I personally would like to see more done.

Mr. DADDARIO. That is all, Mr. Chairman.

The CHAIRMAN. Mr. Moeller?

Mr. MOELLER. Dr. Stever, on page 6 of your prepared statement, the last paragraph you made mention of the activities of yours that contribute directly to the ability of the country to meet the challenge by improving technological capabilities of our scientists, et cetera.

Then you go on further to say:

> This did not start at the launching of Sputnik I but was already under way by the end of World War II.

We are told that the Soviets got in dead earnest in this immediately after World War II. If we had this ability then, what accounts for this tremendous gap at the present time? I am sure this Government must have looked to you people for the guidance and the advice and for maybe the prodding that might have been necessary at this time.

Why did we wait so long before we actually got into this?

Dr. STEVER. I think this is a very good question to delve into. There is no question that a number of our people in this country were developing their own strengths, they were doing research, doing development in this area, in fact, they were being supported by the Government. Their support in this area was not as high, apparently, as it was in Russia.

The balance of opinion in this country was that our engineers and scientists should work—the majority of them should work on other things. I think time has shown that our balance wasn't proper.

Mr. MOELLER. To whom were these reports made? Who had this information and wasn't using it?

Dr. STEVER. I think every agency of the Government was pretty well aware of the work that was going on in this field. I can't think of any agency that didn't have it in their reports.

Mr. MOELLER. So it was negligence on the part of people in Government that we didn't pick this thing up and get going?

Dr. STEVER. I don't know whether negligence is the proper word. I think their judgment indicated we should go elsewhere. I am afraid that we all benefit by hindsight here. We mustn't fail to remember that we did maintain the strongest nation during those years. Possibly we had the wrong balance between future strength and present strength, but nevertheless we had strength then.

Mr. MOELLER. Nevertheless, we don't want to repeat any of our mistakes.

Dr. STEVER. No, sir.

Mr. MOELLER. We are told that the Soviets have leapfrogged much of what we have been doing in the way of huge bombers, et cetera. They went immediately into missiles. Haven't you fellows got some idea now that we can go beyond missiles? Why are we sitting around and letting the Russians leapfrog again?

Ought we not be thinking about—well, you name it, I don't know what it is, but there should be something.

Dr. STEVER. We are getting far afield from my representation for the Institute of the Aeronautical Sciences.

Mr. MOELLER. This is certainly going to be in your field.

Dr. STEVER. But I would say that every member in the community of scientists and engineers that I know is looking very hard at the future. But let's not say that just because one leapfrogging has been accomplished, we can forget that field and go on to a new field.

Mr. MOELLER. They maybe won't be able to leapfrog any more?

Dr. STEVER. That is right.

Mr. MOELLER. One final question—any of the four of you can answer it: Are you willing to make a statement—you are, I am sure, familiar with the Mercury program. Are you willing to make any statement as to what you think of its present value with respect to putting man in space?

Do you want to stick your neck out on it?

Dr. STEVER. Well——

Mr. MOELLER. I don't care who answers.

Dr. STEVER. May I say again that this is a personal remark and doesn't represent the Institute of the Aeronautical Sciences in any way. I think it is a program which is needed in the field. When taking our first step, it must be rather simple. I think the Mercury program is an important first step. I don't think it is the only possible first step one could have thought of.

Mr. MOELLER. Do you think there is a possibility we could have bypassed this?

Dr. STEVER. I suspect if we went back a few years in time and selected a different program we might have done better, but at this stage I don't think we should abandon it and go on to another one which, in turn, may be abandoned 4 or 5 years in the future.

I think we have to take these first steps so let's get on with the job. That is a personal opinion.

'Mr. Moeller. That is all.

The Chairman. Mr. King?

Mr. King. I should like to ask a question to whichever of the four wants to take a crack at it. General Medaris in his testimony to this committee, of course, advocated very vigorously, as you gentlemen know, a unified space program under one unified authority or agency and his feeling, of course, was that the Department of Defense, since it was in the picture and has been in it traditionally from the beginning and has available its technical services and procurement and all of the rest. He felt and argued persuasively that the Department of Defense should remain in control of the program and that it should be unified under the Department of Defense.

Among other things he also argued—and this, I think, was quite persuasive and affected me. He said it is impossible where you have two agencies carrying on a single program like this—it is impossible to coordinate all of the technical work, the experimentation that is being done.

Invariably you will have in your separate agencies—you will have the same type of work being done and it is impossible to have one central clearinghouse to make certain that you don't have duplication, overlapping, and so on.

If you have one agency, he said, you can do that. You have a clearinghouse, you don't have the situation of two laboratories or two departments carrying on the same research.

But where you have two entirely different commands, that type of overlapping is inevitable. He argued that there would be a saving of at least 20 percent by uniting all of our space activity under one administration.

I should like to get your comments on that line of reasoning.

Do you feel specifically that there is an inevitable overlapping and duplication of technical effort where you have NASA on the one hand and you have the Department of Defense on the other hand, both in the space field and both in R. & D. aspects of space?

Whoever would like to comment on that. This is a great problem, of course.

Dr. Seifert. Thank you for the privilege.

I think it is important that the civilian influence on what is essentially a scientific program not be lost. Admitted that things could be more efficient if under a single strong head, my own personal reaction—I am speaking only as an individual—would be that a civilian influence should be very strong in guiding this program. If it has to done through a second agency, then so be it.

I would not want to sacrifice the civilian control of certain portions of the program for the sake of 20 percent of the program.

Mr. King. You think his argument, though, may have some merit on that 20 percent?

Dr. Seifert. Yes.

Dr. Arthur. I think the single agency approach is certainly a good one. I am not prepared to say which agency, although, for example, in the applications area when you consider what we think about in the future, like networks of communications satellites or networks of navigation satellites, certainly programs of this scope should be under one agency.

Dr. STEVER. Again this is a personal belief; since I believe there are important military goals and important nonmilitary goals, I think it is important to have two agencies.

I believe that if the space program is put under a military agency, the military goals will be achieved at the expense of the nonmilitary ones; and if the space program is put under a civilian agency, the nonmilitary goals will be achieved at the expense of the military ones.

I think they are both good goals and we ought to have both groups.

Mr. JACKSON. In nonmathematical and nonscientific problems there are often a number of solutions and men, if they want to, can make several solutions work, any one of several work, and I think that can be done in this case.

Sure, there will be a little overlapping, but if men are alert to try not to have it, it can be held down.

There isn't really a distinction between the missile business, say, and space business. They both are contiguous until a rocket-propelled missile, say, is well out into space with things for science and whatnot with it. Up to that point they all use much the same boosters and the same missiles and so on.

Mr. KING. Would I be correct in assuming that all four of you gentlemen would be of the opinion that a very strict, tight cooperation and collaboration and coordination between the space and the military aspects of our space program would be essential?

Mr. JACKSON. Yes.

Dr. STEVER. Yes.

Mr. KING. If we have the two commands, certainly they must work together as a team on all levels. I think I would agree.

Dr. STEVER. Yes, sir.

Dr. SEIFERT. Yes.

Mr. KING. That is all.

The CHAIRMAN. Mr. Morris.

Mr. MORRIS. I just have one question.

Mr. Seifert, on page 7 of your testimony you list the board suggestions for increased studies in various fields and among them you list metallurgy.

Would you give us a little bit more detail on what you mean there, specifically? Do you mean high temperature research on metals?

Dr. SEIFERT. I mean those aspects of metallurgy which relate to astronautics. That could be high temperature metallurgy or it could be the properties of metal in space which in the absence of atmosphere may be different from those at the surface of the Earth.

I was primarily thinking in this list of those experiments that are done in conjunction with satellite-engineering laboratories; I wasn't trying to be too broad in this list.

Mr. MORRIS. There would be very high temperatures.

Dr. SEIFERT. That is one phase. That wouldn't necessarily be studied in space. It might, as in the case of a nozzle of a rocket engine which is operating at a high temperature.

Mr. MORRIS. Thank you.

The CHAIRMAN. Thank you.

I want to thank all of you gentlemen for appearing here before the committee. We appreciate your fine statements. They will be printed in the record in full, together with the questions and answers that have been propounded to you.

If at any time you feel the committee should be aware of any views that you may have, strong views on this subject, we will be glad to hear from you.

Should vital questions come up in the future, we would like to feel able to call upon you for your valuable assistance. We want to thank you very much.

Now, at this time I have two or three matters that I would like to take up with the committee. I think it probably can be best taken up in executive session. So if there is no objection, we will go into executive session.

(Whereupon, at 11:43 a.m., the committee proceeded in executive session, on matters of internal administration. The committee adjourned at 12 o'clock noon to reconvene at 10 a.m., Wednesday, February 25, 1960.)

REVIEW OF THE SPACE PROGRAM

WEDNESDAY, FEBRUARY 24, 1960

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C.

The committee met at 10 a.m., Hon. Overton Brooks, chairman, presiding.

The CHAIRMAN. The committee will come to order.

This morning, members of the committee, we have a very distinguished witness here to talk to us. We have been wanting to have Dr. Pickering for some time. Now, I want to say before I introduce Dr. Pickering that it is the purpose of the committee to pick up—we didn't quite finish our posture hearings. There are some witnesses still outstanding, unheard, and Dr. Sheldon knows about them. It is my purpose to pick them up as we go along at convenient times and hear the rest of them so that we will complete the posture hearings.

The ones that we have not heard from are largely nongovernmental witnesses and I think the committee would be especially interested in that. We have not heard, also, from some of the atomic witnesses. I think we ought to hear from them, also.

So, Dr. Sheldon, if you will gather together a list of those that we still have scheduled to be heard, we will try to work them in at convenient times.

Now, again, members of the committee, we have Dr. William H. Pickering, director of the Jet Propulsion Laboratory of the California Institute of Technology.

Dr. Pickering's biography is before the members.[1] He has appeared previously before this committee and we welcome him back. The laboratory which he heads has made important contributions to the defense of this Nation over many years. Under his leadership, it made key contributions also to the first American satellite and to the first and only American device in solar orbit.

The Jet Propulsion Laboratory has now passed from its former close relationship with the Army to become the largest contract facility under the general control of the National Aeronautics and Space

[1] Pickering, Prof. William Hayward, California Institute of Technology, Pasadena, Calif. Electrical engineering. Wellington, New Zealand, December 24, 1910; naturalized 1941; married 1932; two children; B.S., California Institute of Technology, 1932; M.S., 1933; Coffin fellow, 1933–35; Ph. D. (physics), 1936. Assistant and teaching fellow physics, California Institute of Technology, 1932–36; instructor, 1936–40; assistant professor, electrical engineering, 1940–45; associate professor, 1945–47; professor, 1947–; division chief, Jet Propulsion Laboratory, 1952–54; director, 1954–; lecturer, Southern California, 1938. Civilian with Research Development Board; Air Force; U.S. Army, 1944. Instructor, electrical engineering; senior member Institute of Radio Engineering, cosmic rays; telemetering from balloons and rockets; microwave propagation; development of cosmic ray radiosonde; missile guidance problems. (From: American Men of Science.)
Committee note: Dr. Pickering is director of Jet Propulsion Laboratories, California Institute of Technology, Pasadena, Calif.

Administration, insofar as ownership of facilities and assignment of funds for work is concerned.

Having Dr. Pickering here today represents the first opportunity of this committee to hear from a distinguished American as to how the new arrangement for the Jet Propulsion Laboratory under NASA is working out.

It also represents a rare opportunity for us to hear the independent and courageous views of a man of respected judgment on our national space program.

Dr. Pickering, you have a prepared statement?

Dr. PICKERING. Yes, Mr. Chairman.

The CHAIRMAN. Needless for me to tell you, the committee has profound respect for your statements and your judgment. When we have finished with your statement, we are probably going to ask you specifically about how the new arrangement for the Jet Propulsion Laboratory is working insofar as you see it.

We will be delighted if you will proceed with your statement.

STATEMENT OF DR. WILLIAM H. PICKERING, DIRECTOR, JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY

Dr. PICKERING. Thank you, Mr. Chairman.

Mr. Chairman, members of the committee, I appreciate this opportunity to discuss the national space program, its direction, and its impetus with the members of this committee.

To put what I have to say in perspective, I would like to go back to the pre-Sputnik days, when President Eisenhower announced that the United States would attempt to launch a small Earth satellite as part of the International Geophysical Year program.

The CHAIRMAN. Wait just a moment. Can everyone hear the doctor with the loudspeaker where it is? You might pull it a little closer to you, Doctor.

Dr. PICKERING. Yes, sir.

I think that most scientists associated with that program visualized it as being a low-pressure, slowly evolving effort, starting with relatively few shots of space payloads having capacities measured in a few pounds or tens of pounds. I think they saw this as a state of affairs which would exist for several years and would then gradually work up to larger space vehicles and, ultimately, to lunar and planetary exploration. Only a few enthusiasts were concerned with a rapid rate of advance of our space capability and a rapid development of large launching vehicles.

Most of us concerned with space in 1955 would have dismissed as incredible the statement that in the 1960's the United States would be spending almost $1 billion on a space program. Let us remember that in 1955 the United States was everywhere the recognized world leader in technology, in know-how, in daring and imaginative engineering projects.

Now, in the short space of 5 years, we find the situation dramatically reversed. We do not debate the necessity for large expenditures in a space program, and the position of the United States as a techno-

logical leader in the world is seriously threatened, and perhaps overcome.

I was interested in reading several weeks ago the results of an international public opinion poll in which the people of 10 nations were asked which country would have the leading position in science in 10 years. People in 8 of the 10 nations polled believed that Russia will hold the leading position in science by 1970; only in Greece and the United States was there confidence that the United States will hold the top position in science at that time. (Gallup poll, as reported in the Los Angeles Times, Monday, Feb. 15, 1960.)

What has caused this dramatic reversal in world opinion? I think there is a complex of answers, but certainly one of the most important factors involved is the unexpected and dramatic advance of Russia in the technology of space.

Shortly after Sputnik, Dr. Killian's committee presented a space primer in which a calm assessment was made of the reasons for a space program. Among other things, the space primer listed four objectives for space exploration. In brief, these were scientific, commercial, military, and human objectives.

With the hindsight that comes 2 years after the event, it would seem to me that the space primer omitted the most important immediate objective; that is, to equal or exceed the achievements of Russia in space. In other words, we should frankly admit what the rest of the world knows—that we are indeed in a race with the U.S.S.R. in space. One can come to no other conclusion.

The organization of the National Aeronautics and Space Administration occurred only 10 months after Sputnik I, and indeed it can be argued that the size and magnitude of the U.S. civilian space effort since then has been greatly influenced by the Russian program. The Space Act declares in section 102, paragraph 5, that one of the objectives of the NASA is "the preservation of the role of the United States as a leader in aeronautical and space science and technology, and in the application thereof to the conduct of peaceful activities within and outside the atmosphere."

Between October 1957 and February 1960, the U.S.S.R. successfully launched three satellites and three lunar vehicles, each one different, better, and more dramatic. Russia, quite frankly, attaches great weight to the propaganda value it can extract from its space program, and at least one major objective of this program is a well-planned campaign that can convince the world that Russia, and not the United States, is the technological leader of the world.

I think it is most important to recognize that Russian leadership in space technology is extrapolated by people everywhere to mean Russian leadership in all technology. I was interested in reading some time ago (Los Angeles Examiner, Wednesday, Feb. 3, 1960) of a proposal to import small Russian cars to the United States for sale to the U.S. public. Five years ago, before Sputnik, the idea that a U.S. car-buying public would choose to buy a Russian automobile would have been regarded as absurd. But now, because of the Sputnik and Lunik shots, all Russian technology is suddenly invested with an aura of excellence.

While Russia has been skillfully exploiting these space successes in the past 2 years, what have we done in this country to compete? Actu-

ally, we have done a great deal, but much more remains to be done before we can say, in the words of the Space Act, that we are preserving the role of the United States as a leader in aeronautical and space science and technology.

The real problem results from our confusion and indecision as to what the exploration of space really means, and what is the motivation for the exploration of space. There have been statements, frequently conflicting, from Government sources, military sources, and experts in all fields, as to what the United States should do, and why. There has been confusion as to the relationship between the missile program and the space program—between the civilian space program and the military space programs. It seems to me that this is the heart of the problem. If we can really understand the motivation and the reasons for the space program, and agree upon this, then it is easy to establish the priorities and support necessary for the program.

I think that we should first understand the difference between the missile program and the space program of the country. It is true that the space program utilizes the large military missiles as booster vehicles, but beyond this there is very little relationship. Military missiles are being developed for a specific purpose as part of the military weapons systems, and as such, they must indeed have the very highest priority. I do not wish to comment about the so-called missile gap, but I have no hesitation in saying that I find it not only proper but necessary for the military to be developing accurate and reliable long-range ballistic missile weapon systems.

Our space program, and here I include both our military and our civilian space programs, is not in any way analogous to the ballistic missile weapon program. In a word, we can say that the missile program is developing a weapon to be used in war or to prevent war; and our space program is a cold-war weapon. It seems to me that if this key point could be accepted by the scientists on the one hand and the military on the other, then we as a Nation could establish a space program which would quickly reestablish our technological position in the world. At the same time, the scientists should be able to conduct the scientific exploration of space, and the military would be in a position to exploit possible military applications of space.

My concern with our present space program is that, as it is currently evolving, there is an increasing tendency for military applications to dominate the space picture. This, I believe to be unfortunate as far as our international position is concerned, and also as far as internal support of the total space program is concerned. Clearly, the military and civilian programs must compete for relatively scarce manpower and facilities as well as dollars, and because of the very high costs of this program, unnecessary duplication and competition should obviously be avoided. Therefore, it is essential that the program be kept in proper balance, consistent with our real national space objectives.

Last month, the President submitted to Congress some proposals for changes in the Space Act of 1958. I believe that these proposed changes would indeed clarify the fact that there should be a well established civilian space program as well as a military program, but I am concerned that there is no place in the act which provides that the program be kept in proper balance. True, there is provision for

the Administrator and the Secretary of Defense to advise and consult with each other concerning their respective programs, but since the Department of Defense is permitted to conduct such research programs as are deemed necessary to support the weapons activities, it appears to me that on many occasions, both the NASA and the DOD will be conducting almost identical research activities.

Furthermore, there is nothing to prevent military space systems of only peripheral value from demanding such a large share of research support in both the DOD and perhaps the NASA that these efforts dominate the space program to the detriment of our real objectives.

It appears to me that the answer to this problem is to require a greater coordination and cooperation between the NASA and the DOD in this area of space; in other words, to require a truly unified national space program. Conceptually, I believe the problem could be solved in one of three ways: Giving essential control of the program to the NASA, to the DOD, or to some third office superior to either in this area. This last concept I dismiss as being unnecessary and probably unworkable. Of the other two, I believe that the NASA should indeed be strengthened to the point where it effectively controls a complete unified national space program.

I believe this was the intent of Congress when the original act was written in 1958, and in view of what I consider to be the primary motivation for a space program, namely, its cold war importance, it seems to me essential that the program be effectively unified by the civilian space agency. If a decision were made to put the entire unified program under the NASA, this agency would then indeed be required to produce the bold and imaginative program which is so badly needed. It appears to me that the program submitted to your committee in these last few weeks represents bold and imaginative thinking based on solid engineering analysis. The NASA has come a long way in the past year. The time has now arrived when it should be clearly responsible for our entire national space effort.

Unless we pursue these goals with energy and solve some of the troublesome problems, we may unhappily be in the position of having to say, as Cassius said to Brutus:

> The fault, dear Brutus, is not in our stars, but in ourselves, that we are underlings.

Thank you, gentlemen.

The CHAIRMAN. Thank you, Dr. Pickering, for a very excellent statement.

We are certainly happy to have you here and your words there are most timely. You are head of the Jet Propulsion Laboratory which is doing a whale of a good job out there on the Pacific coast.

In behalf of my colleague, Mr. Fulton, I want you to be assured of our strong support for the missile and space programs.

I want to ask you a question or two regarding your statement.

How do you find the situation working now under the new arrangement for the Jet Propulsion Laboratory?

Dr. PICKERING. Well, sir, during this past year, the Laboratory was transferred from an Army contract to a NASA contract, with a provision that the Army programs in progress at the Laboratory would be phased out in reasonable fashion.

This is being done and is being done very successfully. The Laboratory will be essentially out of its Army programs by about the middle of this calendar year.

The CHAIRMAN. Does the NASA seem to have the proper perspective of the type, character, and capability of the Jet Propulsion Laboratory for work?

Dr. PICKERING. Well, sir, I think that during this past year we have evolved a relationship with NASA headquarters which I find is becoming very satisfactory. I think that we have clearly established the role of the Jet Propulsion Laboratory within the entire NASA effort. In a word, this is that the Laboratory will be responsible for the lunar and planetary programs of the NASA.

In other words, our interest is in the field of space craft and scientific experiments to be conducted on vehicles which will go to the Moon and beyond.

The CHAIRMAN. Then your leadership in the Jet Propulsion Laboratory seems to be fairly satisfied, is that correct, with the arrangements now developing in the organization, the larger organization of the NASA?

Dr. PICKERING. Yes.

It would be, of course, not correct to say we have not had our troubles during this past year. With a new organization, with a change of contract management, et cetera, there have been inevitable difficulties; but I feel these are becoming resolved and, as I say, I feel that our role within the NASA is becoming clearly defined and I look forward to a very satisfactory relationship with the NASA.

The CHAIRMAN. Well, would you say then that under this new arrangement Jet Propulsion Laboratory will be able to do just as good, if not a greater job than they have done in the past for the space effort?

Dr. PICKERING. I hope, sir, that particularly with the ABMA team, Von Braun's team, coming into the NASA, that we will indeed be able to do at least as well and I hope better than we have done in the past.

The CHAIRMAN. Fine.

Dr. PICKERING. I think that the——

The CHAIRMAN. Now, you suggest a closer relationship between the DOD, the Defense Department, and its various departments under the Defense Department and NASA. Now, what is your opinion regarding the military liaison committee which the law creates to maintain proper relationships between the two departments?

Dr. PICKERING. Well, sir, I think if there is not a very close liaison between the two departments, between the Department of Defense and the NASA, that the two groups will develop space programs which will sap the energies of the country from the point of view of manpower and resources and they will inevitably be conducting parallel programs instead of a unified program.

The CHAIRMAN. And waste a lot of money and a lot of manpower; is that correct?

Dr. PICKERING. Yes, sir; that is my opinion.

The CHAIRMAN. You would have, though, according to the way I read your statement, you would have the balance established by NASA.

Dr. PICKERING. Yes, sir.

The CHAIRMAN. As a peacetime agency rather than the Defense Department?

Dr. PICKERING. Yes, sir. Because I feel that at the present time it is more important that the primary effort in space be civilian oriented rather than military oriented. In other words, my feeling is that the military applications of space are not clearly defined at this time, that this may very well develop; in fact, past experience would say almost surely that it will develop, but I would regard this as being a natural development out of a program which is oriented in the direction of a civilian space program.

The CHAIRMAN. You would not take, however, from the Defense Department the applied development in the field, for instance, of weapons and missiles——

Dr. PICKERING. No, sir.

The CHAIRMAN (continuing). That the Defense Department needs in the normal defense of this country?

Dr. PICKERING. No, sir; I would certainly insist that the Defense Department do the best job it possibly can in the field of missiles and that it be alert to the opportunities presented by developments in space, to use these as the occasion arose.

The CHAIRMAN. But you would permit NASA to take the leadership in pure science, basic science and take over more or less that field, the research and development program.

Dr. PICKERING. Yes, sir; and also in developing an overall program to have a comparable dramatic impact to the Russian program.

The CHAIRMAN. I ask these questions because the next hearings we will have in this committee will be on the Presidential proposals for changes and what you say will be very influential with the committee.

Mr. McCormack?

Mr. MCCORMACK. I am glad to see you again, Doctor.

Dr. PICKERING. Thank you, sir.

Mr. MCCORMACK. We have a lot of fine, young Americans and I hope they are sapping in the atmosphere [in reference to part of the audience at the hearing]. We have one of the outstanding leaders in the field of science testifying, Dr. Pickering. Doctor, in the world of today we have got to be very practical.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. We have to realize the question of self-preservation; is that right?

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. Not only of ourselves personally, but the way of life we believe in.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. And our way of life is being challenged, sharply so.

While I recognize the importance of nonmilitary research and development—I was Chairman of the select committee out of which NASA came—we have to be practical in the world of today and realize not only the potential but actual danger that confronts our way of life, the way of life we believe in, democratic institutions of Government.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. The job we have to do, would you agree, is to try to create a harmonious relationship between the civilian agency and the military to make the maximum contributions to our national interest and our national preservation?

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. As a matter of fact, most of the developments in the field of research in the past conducted by the military have had tremendous peaceful results; is that right?

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. You don't advocate the elimination of research and development by the military in the world of today; do you?

Dr. PICKERING. No, sir; I do not. I think the military is doing a fine job in supporting a great deal of fundamental research in many areas.

Mr. MCCORMACK. You wouldn't—would you take the position that in the field of military research and development, and civilian, that the military should be subordinated in the world of today, to the civilian?

Dr. PICKERING. Well, sir, if you are referring particularly to the area of space research then what I believe is that having established the NASA as an independent agency to conduct a space program, that this agency should, indeed, establish the national programs, part of which may very well be done by the military, but it should be done in a coordinated fashion with NASA taking the lead.

Mr. MCCORMACK. You mean the NASA taking the lead in the——

Dr. PICKERING. In the research.

Mr. MCCORMACK. In the basic research.

Dr. PICKERING. In this particular area of space.

I single this out because I feel that the——

Mr. MCCORMACK. I am just exploring your views, you understand.

Dr. PICKERING. Yes, sir.

Mr. MCCORMICK. My views are not to be judged by any questions I ask.

Dr. PICKERING. No.

I single out the area of space research because of the very high costs of this. The payoff in the space program is obviously the material which you deliver in space and the data which you get back from space and this is a very expensive business. It is a business which, of course, requires the support of the military, because quite obviously a space-research program must be conducted using rockets and the whole art of rocketry which has been developed by the military at this time. I think in the future the space-research program may very well develop its own rocketry with its own special requirements.

But because of the cost of this program I feel that the Nation cannot afford a completely independent and uncoordinated program between the civilian and military programs.

Mr. MCCORMACK. Now, you are talking about another thing. I agree with that; there should be a coordination, but I was trying to go beyond that to see what your thinking was on the question of priority—at this point in the world's history. I am not talking about a peaceful world. You can't deal with the Soviets on a moral plane;

they have no moral origin, that is the institution as such. I am not talking about the people of Russia or many of them. I am talking about the regime in control.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. And if they have no moral origin you can't deal with them on the idealistic level.

Dr. PICKERING. No, sir.

Mr. MCCORMACK. And therefore it is on the level of the law of self-preservation——

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. That we are forced to consider these questions.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. Idealism is one of them and I am for it. I have ideals, but I try to be practical in the world of today.

Dr. PICKERING. Well, sir, I think I am also trying to take a practical approach, which says namely that the military must devote its efforts and its support to the military-weapons systems and I would regard the intercontinental and long-range ballistic missiles as a very important weapons system which the military must indeed be supporting and be supporting with very high priority. I regard the space program as, indeed, another part of this struggle between two conflicting ideologies, and that to much of the world the achievements of the United States in the space program are a very important factor in their attitude toward the United States. Therefore, I feel it is essential that the United States have significant and dramatic achievements in space.

The question it seems to me hinges around How does the United States organize to accomplish this? It seems to me that having established the NASA, having set up a definite channel of scientific and general civilian achievement in space, that the United States should pursue this route with the military putting its research efforts in the field of missiles, as such, the NASA putting its efforts in the field of space.

Mr. MCCORMACK. How about reconnaissance satellites, that could be used for both military and peaceful purposes, what would you say on that?

Dr. PICKERING. Yes, sir; this reconnaissance satellite may indeed be a useful military weapon.

Mr. MCCORMACK. There are various types of reconnaissance satellites.

Dr. PICKERING. Yes, sir. I think the only question I would raise is whether or not one should at this time embark on a full-fledged reconnaissance satellite program or should one say to the NASA: "Move ahead as fast as you can in developing the technology appropriate to reconnaissance satellites."

For example, NASA is proposing to conduct some experiments with a meteorological satellite which will explore cloud cover and so forth. This surely is a——

Mr. MCCORMACK. What about—I don't want to interrupt you. Go ahead, Doctor.

Dr. PICKERING. This surely is the first step in looking at the Earth from a satellite, in transmitting back to the ground signals from the satellite which give you a picture of what the satellite sees.

As a result of this, then, it seems to me one moves ahead into the next step as to whether or not this is a military weapons system, rather than to say at this time, when nobody except the Russians have produced a picture which has been taken from a satellite, should we at this time conclude that we can indeed see our way clear to develop a reconnaissance satellite system.

The CHAIRMAN. The gentleman's time has expired there.

Mr. Fulton? Mr. Fulton has lost his voice. [Laughter.]

The CHAIRMAN. Mr. Anfuso—that gives the committee a little break here. [Laughter.]

Mr. ANFUSO. May I say that in the absence of Mr. Fulton's voice that he has certainly made a very valuable contribution to this committee in his questioning. He has always been very enlightening.

Dr. Pickering, you talked about a cold war. Isn't that really the thing that we are going to be mostly concerned with in the next few years, a cold war?

Dr. PICKERING. Yes, sir; I certainly hope it is not a hot war.

Mr. ANFUSO. And in a cold war you are fighting to capture men's minds all over the world; isn't that correct?

Dr. PICKERING. Yes, sir.

Mr. ANFUSO. And the nation which convinces the rest of the world that what they are doing is for peaceful purposes will gain more friends; isn't that correct?

Dr. PICKERING. Yes, sir.

Mr. ANFUSO. Now, do you see a hope in the peaceful discoveries in outer space which someday can create an abundance and a sufficiency in this world to make all nations recognize the futility of war?

Dr. PICKERING. Well, sir, it is difficult to predict exactly what will be the outcome of our ventures into space, but we can certainly say that at this time we have reached the stage in the development of mankind when mankind for the first time is able to look beyond our planet. We have explored our planet, we have mapped it, we have walked all over it and so forth and now we are beginning for the first time to go off the planet, and the ability to do this, it seems to me, is something which has fired the imagination of people all over the world and therefore achievements in this area are going to be looked upon by people all over the world as a very important index of the capability of a nation.

Mr. ANFUSO. Right. Now, Dr. Pickering, do we have the capacity now, both moneywise and in talent to not only catch up with the Russians in this space effort but also to surpass them? Your answer is "Yes"?

Dr. PICKERING. The answer is "Yes." I must qualify it——

Mr. ANFUSO. Let me go on to another question. If your answer is "Yes" I will take it. And would you say we have had that capacity for the past several years?

Dr. PICKERING. Yes, sir.

Mr. ANFUSO. Now, a gentleman testified here yesterday, representing a very large association, and he said that we should spend $4 billion more in this space effort. Supposing, Dr. Pickering, you were chosen to tell the Nation how that money should be spent and supposing you were given $1 billion, $2 billion, $3 billion, or $4 billion,

do you think you can find ways of properly spending that money in this effort to not only catch up with the Russians, but to surpass them?

Dr. PICKERING. No, sir; I would disagree. I do not feel that $4 billion spent, say, this year——

Mr. ANFUSO. I didn't say this year. I say $4 billion. You see, the Russians don't have a goal for 1 year, they speak about plans, 5-year plans, 10-year plans.

Let us suppose that we had a plan—we only planned for today and we have never planned for tomorrow. Let's suppose now—let's look into tomorrow and say we had $4 billion, do we have the ingenuity right now, capable men such as yourself, where you could say: Well, we can start this project or that project, which 3, 4 years from now will pay off? Do we have that ingenuity?

Dr. PICKERING. Yes, sir; we do have that ingenuity.

My concern, of course, must be geared to what is the total technical effort which can sensibly be applied in these areas and I don't know what the figure is. It is obviously a growing figure. If we have a program which is a growing program, then we can build to the effort as time goes on.

Mr. ANFUSO. Do we have a growing program?

Dr. PICKERING. I believe that the program as submitted by the NASA, this 10-year program I feel is a growing program.

Mr. ANFUSO. Could we improve on it, could we have a better growing program?

Dr. PICKERING. Given more money, more effort, yes, it could grow faster.

Mr. ANFUSO. That is what I want to know.

The CHAIRMAN. Mr. Van Pelt?

Mr. VAN PELT. Dr. Pickering, I certainly am glad I attended this session this morning because I appreciate your statement. You have clarified a number of things that have concerned me and concerned me with regard to propaganda that we, ourselves, are putting out for the general public here in the United States.

On page 3 of your statement you mention that Russia quite frankly attaches a great deal of weight to the propaganda value it can extract from its space program.

Now, I am wondering just what we can do, either as individuals or as a committee, a part of the U.S. Congress, to help, because we have had many witnesses before this year and last year that have pointed out many dramatic accomplishments that we have made.

Dr. PICKERING. Well, sir, it is true that we have made some dramatic accomplishments. Unfortunately they have not been firsts and unfortunately they have not been as dramatic in the eyes of the man in the street as the Russian accomplishments. Now, I do not feel that we can reverse this situation overnight. The Russians have a demontrated capability of putting very large payloads into orbit. They have apparently the ability to put these into orbit when they want to, approximately when they want to, and—one doesn't know what their next step will be, but one can be assured that it will be some additional dramatic step. They seem to be more concerned with making each step a dramatic advance over the previous one, rather than consolidating their scientific work.

I think in order for us to be doing comparable things, we must, first of all, have the comparable vehicle capability and ability to fire successfully essentially when we want to.

This is a matter of time because of the engineering experience which is inevitably associated with this and therefore, it seems to me that what we can do now is to convince the public that we have an evolving program here and that with a little patience we will be able to conduct experiments and do things comparable to what the Russians are doing. But I do not think that we should mislead the public into believing that overnight we are suddenly going to do something really dramatic or something really startling, as measured by the Russian standards.

Mr. VAN PELT. Well, Doctor, on this you may or may not want to comment, but I have been one of those that is not too sympathetic to the foreign aid program that we have had, particularly the amount of money that we have been spending. Apparently we haven't bought any friends with the dollars. Would I be right in suggesting that perhaps we ought to amend this appropriation bill that is coming out and designate a part of that money for propaganda on this program to see if we could increase our friends with it, rather than just trying to buy it with dollars?

Dr. PICKERING. Sir, I am afraid I find that a difficult question to comment on.

It seems to me there are many facets of the foreign aid problem with which I am not familiar, but I will say, again, that if we can conduct a space program which begins to match and exceed the Russian program, that we will buy a tremendous number of friends with it.

Mr. VAN PELT. Thank you very much.

The CHAIRMAN. Mr. Sisk?

Mr. SISK. Dr. Pickering, at the top of page 3 you make this statement, after commenting on hindsight and the Space Primer, that in other words, we should frankly admit with the rest of the world that we are indeed in a race with the U.S.S.R. in space. One can come to no other conclusion. Some of us have hated to admit this, but I am, of course, in agreement with what you say.

Dr. PICKERING. Yes, sir.

Mr. SISK. Now, in view of that fact I am concerned with what should be a definite or a primary objective in space and I would like to have your comment on it, not necessarily just this year's primary objective, but, let's say, within the next 5 to 8 years. It seems to me that we should have a prime objective in order to put the maximum effort into it. I have been somewhat concerned as to whether or not NASA actually has that as yet in mind. Now, they have outlined to us a very nice program, various shots that are going to be made, what they propose to do step by step, and yet is that aim—let's ask this: Is that aim to develop and make possible a manned exploration to the Moon or is it something else? What in your opinion should be our prime objective, whether we take it for 4 years or 8 years or whatever it may be?

Dr. PICKERING. The first thing as you have indicated is that there should be an objective, a long-term objective, not something we are going to do this year because the Russians did that, but a long-term

evolving objective. I think in the mind of most of us in this program the eventual objective is manned exploration of the planets.

Now, when that will come, one will undoubtedly find various opinions, but when we say that we are looking at space as an opportunity to step out off the Earth into other parts of the universe, the steps will undoubtedly be first to do this with instruments and eventually to do this with man. We could see it then first in satellites, then in lunar exploration, then planetary exploration, in that order, with instruments first, instruments being put into satellite orbits, they are beginning to go to the Moon, soon instruments will be beginning to go to the planets. Project Mercury will put a man in orbit around the Earth, next step is man on the Moon and next step is man on the planets.

The long-term objective of the goal as far as I am concerned is this long-term objective that says we want to send a man at least to Mars or Venus and safely returning.

Mr. Sisk. I agree in the long range, but let's talk about the next 10 years, let's talk about this decade in which we live. Wouldn't it be helpful if, for example, once and for all we said that our objective, if it is humanly possible, is to put a manned expedition on the Moon in this decade? Maybe you think that is impossible, but visualizing and basing my statement on what you state here is a race with the Russians, what more dramatic and what more important or what even more—in other words, what could produce more in the way of possible value than this? Would you consider that a legitimate, primary objective?

Dr. Pickering. I certainly would; to have a man explore the Moon and return safely to the Earth.

Mr. Sisk. All right.

Dr. Pickering. Now, in order to do this sort of thing one must establish a program which first of all gives you the vehicle capability to do this and it is quite clear that this requires a very large launching vehicle, or else the capability of refueling in orbit or something of that sort, either of two alternatives. In either case this is a tremendous advance in technology as we now know it. Therefore, it seems to me that one should indeed say: Yes, we must proceed with the development of a vehicle capability which is considerably larger than we now have and we must exploit this vehicle capability as we are developing it, exploit it with instruments, but we must keep in mind to put the man in the vehicle as quickly as possible.

Mr. Sisk. Now, that is exactly in line with some of the things with which I have been quite concerned. I am happy to hear you say it.

Now, if you were handling a program to achieve this objective, and, of course, you do have a very definite part in it, then to what extent would you put priority on, let's say, the F–1 engine? I realize there are two possible ways that you people anticipate doing this, one is by an initial launch, which because of the power of the thrust and the size of the vehicle, you could go directly there or you could do it through the rendezvous technique where you have various groups meet in space and then launch out from there.

Dr. Pickering. Yes.

Mr. Sisk. But to what extent do you believe it would be necessary to give a DX priority to the F–1 engine or some similar booster? Let

me explain the context of my question. I am somewhat critical that we have not given the priority to the F–1 engine——

The CHAIRMAN. The gentleman's time has expired, but I think the witness ought to go ahead, if he can, and answer the question.

Dr. PICKERING. Sir, I think I would answer it this way, yes, if I had the resources, primarily financial resources, in this case, I would certainly pursue the F–1 engine as rapidly as I could. I would not, however, discount the clustered engine technology which is being developed with the Saturn, because even the F–1 engine will probably have to be clustered for some of the future missions, therefore, I would pursue both of them really. I would pursue the Saturn effort as fast as I could and also I would get the F–1 engine coming right along, too.

The CHAIRMAN. Mr. Bass, Mr. King has to leave here to make an important appointment at 11. If you have no objection I will recognize him for questioning.

Mr. BASS. No objection.

Mr. KING. Dr. Pickering, I would like to ask a question that may carry us into the realm of the psychological and philosophical but it is a realm that your testimony inevitably leads us. I have always been an enthusiastic advocate for the American system and I am sure I shall be until the day I die. But your testimony raises some interesting questions in my mind. The American system, as I have conceived it, has always featured and specialized in cultivating men of imagination, men who could think tall, see tall, walk tall, be tall, and so on.

Dr. PICKERING. Yes, sir.

Mr. KING. Yet, your testimony is that at the birth of the missile age and the space age the Russian scientists were obviously the ones that were walking tall and thinking tall, taller than we were, rather considerably.

Dr. PICKERING. That is right.

Mr. KING. You suggested in your testimony that our scientists were thinking in terms of very modest space exertions.

Dr. PICKERING. Yes, sir.

Mr. KING. Starting out with just a few pounds and building up to the larger poundage over a period of 10, 20, perhaps 30 years, but the Russian scientists in a comparable situation were compressing into 2, 4, 6 years what we were going to accomplish in 10, 20 or 30 years.

Dr. PICKERING. Yes, sir.

Mr. KING. So, then, in the light of what they have done we immediately reorganize our thinking and we start walking a little taller than we did before. But my question is what was wrong with our system that all of us I know are a thousand percent behind, we know freemen are the ones who should be engaging in the greatest flights of imagination. But I am puzzled as to why the Russian scientists were able to outdo us in the very area in which we have always considered ourselves supreme.

Dr. PICKERING. I would answer that as follows: I would say that we had dreamers who were dreaming just as big as the Russians, but the ones who were more concerned with the, shall I say, with the realities of getting programs going were not dreaming nearly as big and the reason was simply this, that we were basing our extrapola-

tions on the state of the art in large rockets in this country. Let's recognize that at that time we knew very little about the state of the art of large rockets including the work underway in Russia. We had our own rocket developments here and based on just where we were in those developments, this was the sort of thing we had been talking about. Furthermore, let me make one other comment, sir, and that is that for a number of years, in fact, ever since the war, scientists in this country had been conducting an upper atmosphere research program using rockets and it had practically always been a program which was woefully underfunded. There was plenty of imagination, plenty of desire on the part of the scientists to conduct additional research programs with sounding rocket, vertical rockets. If that program had received more support in the late forties it would very naturally have led into the satellite program. But just based on where we stood in the early fifties, our experience with the sounding rocket program, the general state of the art with large rockets, this was as far as we dared extrapolate.

Mr. KING. Dr. Pickering, are you saying then that although we had the imagination, we had the initiative, we had the dreamers who could dream big dreams, that nevertheless the ponderous, waiting bureaucracy and all of the other delays, redtape, and other things that we associate with democratic procedures were sort of squeezing the life out of some of these dreams and hence we were 10 years late.

Dr. PICKERING. No, sir, I would say, rather, that we recognized the fraction of the gross national product that we are talking about when we start talking about a big space program. As scientists we had been accustomed to getting along on a very much smaller fraction of the gross national product and also obviously the only way in which these sorts of funds can be made available is through governmental action and it was not at all clear that governmental action of the magnitude required for this effort would be forthcoming on the word of a few dreamers as to what they could do in space.

Mr. KING. Thank you.

The CHAIRMAN. The gentleman's time has expired.

May I say here that we are delighted to have the classes of Miss Florence V. Curran's class at St. Timothy's School, Stevenson, Md., and also from the class of Mr. Lawrence B. Mayer of Kensington Junior High School, Kensington, Md. I wish we had seats for everybody, but we are glad to have you here.

Now, Mr. Bass?

Mr. BASS. Dr. Pickering, you told us earlier, I believe, that you considered the NASA 10-year program, which was recently presented to the committee as a very good one, is that correct?

Dr. PICKERING. Yes, sir. I said that this does represent an imaginative program with sound engineering thinking behind it.

Mr. BASS. I believe it is fair to say that this program at least to start off with calls for an annual spending rate of about a billion dollars.

Dr. PICKERING. Yes, sir.

Mr. BASS. Now, you also intimated, I believe, earlier that this program could be accelerated if we spent more.

Dr. PICKERING. Yes, sir, this is true. I do not feel competent to give the rate of increase of that program as to whether it should be—

when it should be 2 billion or 4 billion or whatnot, but I certainly must say that if the program was established at a more rapid rate or more ambitious level with a corresponding increase in funding this could be accomplished over a period of a few years. I do not believe that you could go into a $4 billion program this year and spend the money intelligently. I think it has to build up.

Mr. Bass. Would you recommend to this committee that more money be programed than is now being recommended to us?

Dr. Pickering. Well, sir, it is always easy to say. I would like more money. But I think the answer is "Yes," that we could establish a more ambitious program and that really the important thing would be to establish a definite growing program over a period of years which could have some assurance of being supported at a growing level.

Mr. Bass. In what terms are you talking about, Doctor, relative to expenditures, increased expenditures?

Dr. Pickering. Well, sir, I don't know just what figures the NASA 10-year program gets up to, but I imagine it is somewhere in the order of a billion and a half, or thereabouts, on an annual rate. It increases from about a billion to a billion and a half. It seems to me if one was to really put a full-fledged effort into, say, the F–1 engine and the application thereof or a larger effort into the Saturn program, that expenditures of perhaps twice this amount could easily be required.

Mr. Bass. Beginning next year?

Dr. Pickering. Certainly beginning next year. Whether it would come up to twice that amount next year or not, I don't know, but I would say an increase certainly within a year or two to perhaps twice what the NASA program calls for would indeed be intelligently used in a program of considerably greater impact than the program as submitted.

Mr. Bass. Dr. Pickering, the statement has been made earlier in these hearings that because we are behind Russia in this space field—I am talking about the civilian, nonmilitary space field—we are losing friends throughout the world.

Dr. Pickering. Yes, sir.

Mr. Bass. I just can't—do you think that is true?

Dr. Pickering. Well, sir, from the point of view of anything approaching a personal reaction to this, my only contact was that last fall I was in Italy and talked with the U.S. Information Agency in Naples and got their general reaction to this whole program. What they said was certainly consistent with this view, that of—of course, I must say this was right after the Lunik II shot and it was very much in people's minds, but the people at the U.S. Information Agency over there expressed great concern to me as to the sort of—as to the difficulties they had in countering the kind of propaganda which was coming out of Russia centered around the space activities and space achievements and gearing it to civilian and scientific achievements, of course.

Mr. Bass. Well, there is a difference, as I see it, between being impressed by what the Russians are doing and actually going over and espousing the Russian ideology and way of life.

Dr. Pickering. I must agree with you, but on the other hand, I must also feel that if one is impressed with the Russian abilities in

this area, then one will find that when a need for technological support of some sort comes up in a relatively undeveloped country, the reaction is: Let's go to Russia, they will know how to do this better than the United States will.

The CHAIRMAN. The gentleman's time has expired.

Mr. Quigley?

Mr. QUIGLEY. Dr. Pickering, to me the great merit of the NASA 10-year program as it has been outlined to this committee is that it is apparently a well-thought-out program and I think we have heard more than one witness testify before this committee saying that what this country needs to do is establish a definite program and stick with it and not go off in fits and jerks and jumps every time the Russians do something.

Dr. PICKERING. Yes, sir.

Mr. QUIGLEY. I think this is the value and the merit of the program as outlined. What bothers me about it is I think it has certain built-in defects which will invite just the type of fits and jerks that have harmed us in the past. For example, we have a program and if I recall the NASA program it plans putting a man on the Moon, say, somewhere around 1970. I find it difficult to conceive that this country and that this Congress and that any administration that might be in control of the White House will be able to stick to NASA's present program if, for example, the Russians put a man on the Moon in 1966.

I have trouble conceiving this Congress and any administration of this country sticking to NASA's program if Russia puts a man in orbit before the end of this year. In other words, I think the program is realistic in planning in the sense that it lays it out and knows what our capabilities are; it tries to develop and to grow gradually, but my own impression—and I would appreciate your comment—is that it has erred on, shall we say, the side of modesty or it is balanced in the wrong direction.

In other words, I am inclined to feel that instead of a billion and a half, real quick like, if we are going to do anything in the way of catching up—and I agree just not spending money is the answer—I think maybe $3 billion a year, $4 billion a year, $5 billion a year over a period would be the answer. Would you care to comment on that?

Dr. PICKERING. Yes, sir. I must agree with you that if the Russians put a man in orbit next week the NASA program——

Mr. QUIGLEY. We go through the same thing we did after hitting the Moon and after Sputnik.

Dr. PICKERING. Yes, sir. Perhaps the only answer to that would be to put down a program which is, indeed, an ambitious program, one which we can have confidence in, will do well enough to beat the Russians some time soon and then try and support it and not get excited by Russian achievements.

As I said to Congressman Bass, I think that the program could indeed be doubled, shall we say, more or less doubled in expenditure within a few years and accomplish things faster than has been suggested, although as you commented, sir, the answer is not just money alone; you have to build up technical capability and technical know-how, engineering know-how, and this takes time.

I have no answer, really, to your question except to say that I will agree with you it would be unfortunate if we do jump when the Russians do something again next week or next month and that if we had the courage to embark on a program of considerably larger magnitude we could achieve these things sooner.

Mr. QUIGLEY. Well, aren't we bound to jump if we are supporting a program which at the very outstart, I am afraid, is designed not to catch up with the Russians? I mean is this the best we can do? That is what I keep asking myself. If it isn't, why shouldn't we at least try to do more.

The CHAIRMAN. The gentleman's time has expired. Go ahead and answer it, though.

Dr. PICKERING. Thank you, sir.

Well, I frankly don't really know how to answer. Because I can only agree that it is unfortunate if we go by fits and starts in various directions that we have to try and establish some level which we think we can indeed work out both physically and manpower-wise, then we should go to it and expect that within 5 years, 10 years, whatever it may be, that it takes us to beat the Russians that we will have to take that time.

Now, I personally feel that if we really emphasized in our planning, if we emphasized the importance of this race with the Russians, that we could come out with a somewhat different program from the one that has been presented, that we could have a program which would advance us more rapidly.

But in order to advance more rapidly—if I may for a moment digress—in order to advance more rapidly, what we really need is the large vehicle capability.

Granted the ability to fire a very large rocket, reliably, we can do all sorts of things. And, therefore, it is important that we develop this capability as quickly as possible, not that the large vehicle capability is the only thing you need, because, just because you can throw a big lump of concrete out into space, this is interesting but not significant.

To make it significant we have to have spacecraft which can utilize that capability, can support a man in space, can navigate in space, can return to the Earth safely and these are very tough engineering problems which have to be worked on at the same time that the large vehicle capability is being worked on.

Now, the NASA program, as I see it, is aimed at doing these things at a rate which expressed in fiscal terms is somewhere in the order of a billion and a half a year.

The CHAIRMAN. Mr. Hechler. I didn't mean to cut you off.

Dr. PICKERING. No, sir; that is all.

Mr. HECHLER. I want to help clarify some of the answers you have been giving to Mr. Quigley.

Dr. PICKERING. Yes, sir.

Mr. HECHLER. All of us agree we shouldn't respond to Russia by fits, starts, by or with jerks. Nevertheless, isn't it true that our program in this country has moved forward at greater speed because of what Russia has done? I mean hasn't Russia really given us a great break by spurring us to greater action?

Dr. PICKERING. Sir, as I said in the beginning of my paper, 5 years ago none of us visualized the program moving ahead this rapidly.

Mr. HECHLER. Therefore, the thing we have to face in this country is complacency.

Dr. PICKERING. Yes, sir.

Mr. HECHLER. We face a psychological problem.

Dr. PICKERING. Yes, sir.

Mr. HECHLER. And really we should not simply sit back and say we are mature enough to have a program that will not be affected in any way by what Russia does.

Dr. PICKERING. Yes, sir.

Mr. HECHLER. It seems to me—and I would like to get your comment on this—that the stimulus which Russia provides by her activity is, in effect, fortunate for this country, because it helps awaken the people.

Dr. PICKERING. Yes.

Mr. HECHLER. Something which perhaps the leadership of this Nation hasn't done enough of.

Dr. PICKERING. Yes, sir; I certainly agree that the Russian actions have helped to awaken us. What concerns me, however, is the fact that a program of this type involves long leadtimes. One must stay awake for a period of many years.

Mr. HECHLER. All right. Let's follow this out on the issue of long leadtimes. We have been talking in terms of the decade of the 1960's. Now, this group of young people that were here this morning, I think, represents perhaps a cross section of what will constitute the future security of this country. When we talk about long leadtimes isn't it just as important that we enlist the intelligence, the interest, and the application of the younger people today who can help us move forward in technology in the 1970's?

Shouldn't we be thinking of the 1970's and shouldn't we be thinking of how we can strengthen our general education system in order to produce the kind of people that will keep us ahead?

Isn't that just as important as the hardware we produce today and the man we may put in space tomorrow, that we strengthen our educational system in order to continue to move forward?

Dr. PICKERING. Yes, sir; I think it is even more important, because when we look ahead into the next decade we cannot predict what is going to be the important scientific development or engineering development. We cannot now lay out a program and say this is our next 20 years.

Mr. HECHLER. All right. What could we in Congress and the country do in order to strengthen our general educational system in order to achieve that objective? Isn't it just as important to pass a Federal-aid-to-education bill as it is to talk about the things we are talking about this morning?

Dr. PICKERING. Well, sir, I would rather say that it is indeed important that the educational system of the country provides the incentive to young men and women to work hard to develop their talents in the fields of mathematics and science, the fields which will pay off in the technology of the decade after this one.

As to how this should be accomplished, I don't feel that I am in a position to answer that one.

The CHAIRMAN. The gentleman's time has expired. Mr. Daddario?

Mr. DADDARIO. You have recommended, Dr. Pickering, that one of the ways to achieve these ends which you feel are so important is to strengthen NASA so that it is in charge of a national space program.

Dr. PICKERING. Yes, sir.

Mr. DADDARIO. Now, having drawn another conclusion within your statement, what would you classify presently in the space program that the Department of Defense is doing in the peripheral area?

Dr. PICKERING. Well, sir, I would feel that the work, at least the proposed programs of reconnaissance, say, the Midas and Samos programs, which I guess are the large programs in the Department of Defense, I would feel that these programs should be proceeding at a modest rate until we know more about them.

Now, I frankly don't know what the Department of Defense plans are in detail for the development of these two systems. But either one of those systems, if carried out to its logical conclusion, could sap a tremendous amount of the space effort of the country.

Mr. DADDARIO. When you say they should be conducted in a modest manner, do you really mean by that that it should be not done at all and if done, should be under the NASA program?

Dr. PICKERING. I should rather regard these programs as evolving out of the NASA program.

In other words, I would say that taking the specific reconnaissance satellite, that the experience of NASA in developing meteorological satellites and the general technology of observing from a satellite—NASA is going to observe both the heavens and the Earth from a satellite—and that the problems associated with this, the problems of developing this technology are rather difficult engineering problems. I would feel that we would be better off if we were putting all the effort we could into those programs as part of NASA, and then allowing the military reconnaissance programs to evolve out of them, as we see the technology evolving in the NASA program.

Mr. DADDARIO. In answer to one of Mr. McCormack's questions, you said following along somewhat the same line that the Department of Defense should then be alert to the developments in space.

Do you believe that if it is done that way that it will not slow down the military program in space insofar as development of a necessary weapons system might be considered?

Dr. PICKERING. No, sir; I think it would not slow it down because of the following reasons: That in any of these really advanced weapons ideas, there is a tremendous lot of frontier technology which has to be developed. I think that in many cases we try to jump too fast in these things and we are much better off to really put effort into building this frontier technology in a logical fashion and then branching off from it, when the time comes, rather than to say "NASA, you go ahead with your experiments, fund them as best you can, pick up vehicles as best you can, do what you can on it. Department of Defense, you go ahead and evolve a complete system, plan a complete system which is very extensive in scope and hope that all the breakthroughs will come along at the right time."

Now, there are occasions when one has to do this. I think, for example, that the decisions which were made with regard to the ICBM programs in the middle 1950's said that this had to be a crash program,

we had to go into it, we had to conduct necessary parallel approaches in order to get started on this program, with the expectation that the necessary breakthroughs would be achieved.

What I am suggesting, of course, is that the military space systems are not in this category. I obviously should have said, you will obviously find that the military people will disagree with me on this point.

The CHAIRMAN. The gentleman's time has expired.

Mr. Moeller?

Mr. MOELLER. Dr. Pickering, first of all I would like to state publicly my appreciation for the wonderful manner in which you hosted some of us at the Jet Propulsion Laboratory last November. We were very happy to see your institution. Incidentally, I am surprised that you are not asking for more money for that particular place, because of all the places we saw, it seemed as though you were cramped more for space than anyone else.

I would like to see you get more space.

Dr. PICKERING. Thank you sir; I would, too.

The CHAIRMAN. Inner or outer space?

Mr. MOELLER. Outer space, yes.

I would like to digress from this general discussion of the space program to another aspect that I think possibly you could give us some guidance in. Unquestionably we have suffered tremendously, psychologically and in prestige in the world because of what the Soviets have done in space exploration.

Now, you said you were in Italy last fall and I assume that you have had contact with other people that might give you some cue, some hint as to what the Russians might be doing next.

They are certainly not going to stop with space. Now, are they going to come out with some new cure-all for heart trouble? Are they going to have the cure for cancer? They are going to be first in some other things one of these days. Are we conscious of this?

Do you think we are putting forth as much effort as we ought to in other branches of science, not particularly the one we are talking about this morning, to be a match or stay even with them?

Dr. PICKERING. This is a very interesting problem. I think that space has sort of an overruling priority because of the spirit of the times, but I certainly think that we must not overlook the fact that the next dramatic advance is going to be in some other area.

Mr. MOELLER. That is right. Are we prepared for it?

Dr. PICKERING. Are we prepared? I hope so.

Mr. MOELLER. Well, I say it is only conjecture, we know they are going to do something and I hope our people in science are doing something about it now.

The CHAIRMAN. Mr. Roush?

Mr. ROUSH. Dr. Pickering, I was very glad to hear you state this morning that we should frankly admit what the rest of the world knows that we are indeed in a race with the U.S.S.R. in space.

I couldn't agree with you more. As I understand, the one great area in which we are behind lies in this fact that we have not yet developed a super-booster engine, is that correct, sir?

Dr. PICKERING. That is probably the most important area that we are behind.

Mr. Roush. Are there other areas where we are behind?

Dr. Pickering. Probably not. That is, let me say that we know definitely about their capabilities with super-boosters. We know definitely that they are pretty good in the guidance area. Discounting anything they say about their ICBM's, they did hit the Moon, and from the various bits and pieces of tracking data which one can get, they hit the Moon pretty close to the center.

Likewise, we know they have communications systems that are pretty good, they have instruments that are pretty good.

So I don't think there is any other area in which there is any significant difference, in which they are significantly ahead of us.

Mr. Roush. Well this series of dramatic firsts which Russia has managed to achieve has not been attributed directly to their superiority with their large engine, has it, Doctor.

Dr. Pickering. Well, sir, they have to this extent, that the weight capability which they have put into space has been a function of the large engine.

Mr. Rousch. Well, it didn't take a large engine to put a satellite in orbit first, did it, Doctor?

Dr. Pickering. No, sir.

Mr. Roush. It didn't take a larger engine than we have to hit the Moon first, did it, Doctor?

Dr. Pickering. No, sir.

Mr. Roush. It didn't take a larger engine than we have to orbit the Moon first?

Dr. Pickering. I am sorry, sir, let me back off on that one. To hit the Moon, I would say yes, sir, that did require a larger—well, shall I say a larger vehicle than we have actually flown successfully in space.

Mr. Roush. We have gone right by the Moon and missed it with what we have, though, haven't we?

Dr. Pickering. Yes, but that is without an accurate enough guidance system to hit the Moon.

Mr. Roush. Then to hit the Moon you need a larger booster?

Dr. Pickering. Yes, because you put more weight in it to carry the guidance system.

Mr. Roush. And you require a larger engine to orbit the Moon?

Dr. Pickering. No.

Mr. Roush. We plan to do that and even go one step further.

Dr. Pickering. Yes, sir.

Mr. Roush. It didn't require a larger booster to put a dog in orbit, did it?

Dr. Pickering. No, sir.

Mr. Roush. But it is the future that we are concerned with, this matter of being able to put a man into space, this matter of being able to go to the Moon, this matter of a soft landing on the Moon and then go to Mars. Can you tell me why it is that we have been so slow in coming to the place that we suddenly realize the importance of this large booster engine, that only recently we gave a priority to the Saturn and we still refuse reluctantly to give a priority to this large thrust single-engine?

Dr. Pickering. No, sir. It seems to me that this is a logical and reasonable development if one goes back to the immediate post-Sputnik era when it became obvious that we were going to have to embark on

a much more ambitious space program than we were talking about at that time. Clearly the step to take first is to exploit the capability of military vehicles which we now have, namely the IRBM and ICBM, and indeed NASA is proposing to do this. In the NASA program you see the Agena vehicle and the Centaur vehicle being talked about, these being based on Atlas and having capabilities which are thousands of pounds in orbit and a thousand pounds or so on the Moon.

So this capability is a capability which we do intend to use and exploit and to use it as quickly as we can move into it.

Then we go on to the larger ones, so that we are not saying that we will wait until we get the very large boosters and then try to do something dramatic with them. We are building up experience, technology, useful scientific information by using vehicles based on our ICBM, namely on the Atlas.

Mr. ROUSH. I can agree——

The CHAIRMAN. The gentleman's time has expired. Mr. Morris?

Mr. MORRIS. No questions.

The CHAIRMAN. Do you want to ask the question you were going to ask then, where I cut you off?

Mr. MORRIS. I yield my time.

The CHAIRMAN. You can't do it under the rules.

Mr. ROUSH. Thank you.

The CHAIRMAN. May I ask you a question, Doctor: Do you think all of the space projects ought to have DX priority?

Dr. PICKERING. Well, I would like to see the space projects move as fast as the funds and resources available them permit and if this requires a DX priority, then the answer is "Yes."

The CHAIRMAN. Do you know of any of them that should not have a DX priority?

Dr. PICKERING. No, sir, my answer being based on this that all of our experience in space is important because it is all leading into this integrated 10-year program which NASA has presented. And it is important, indeed, that we have such an integrated program.

The CHAIRMAN. Any further questions?

Mr. MCCORMACK. Yes, I would like to ask the Doctor a question or two.

Doctor, you said on page 6 of your statement:

> It appears to me that the answer to this problem is to require a greater coordination and cooperation between NASA and DOD in this area of space. In other words, to require a truly unified national space program.

Now, I can understand that, that means coordination.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. Understanding minds.

Dr. PICKERING. Yes, sir.

Mr. MCCORMACK. In the world of today, wouldn't you put the military exigencies as the primary consideration?

Dr. PICKERING. In this area of space, I would not.

Mr. MCCORMACK. Can't space be used for military purposes?

Dr. PICKERING. I don't know.

Mr. MCCORMACK. Well, suppose it is obvious that they can get up a satellite before we did, say within 300 miles of the Earth's surface capable of projecting a military instrument, say, up to 40,000

pounds on a designated target, a number of those satellites, is that beyond the realm of possibility?

Dr. PICKERING. No, sir, it is not beyond the realm of possibility. It just appears to me it is not a militarily useful way of doing this.

Mr. MCCORMACK. All right. But that would be rather a sharp jolt to us, wouldn't it?

Dr. PICKERING. Yes, sir. But might I suggest, sir, if they had that same weapon on the launching stand in Russia, it should be an equally significant jolt to us.

Mr. MCCORMACK. You say further that, "The time has now arrived when it should be clearly"—meaning NASA, should be "clearly responsible for our national space effort." You probably can reconcile the two statements I have read, but would you do it for my benefit?

I find it a little difficult to reconcile cooperation and coordination with clear responsibility.

Dr. PICKERING. Yes, sir. In the previous page, after mentioning coordination and cooperation, I follow that by saying that as I see it, this requires giving essential control of the program—where I am not defining essential control, but I mean that one of the two agencies must be able to direct a complete program.

Mr. MCCORMACK. I see. You didn't mean by your latter statement that military research and developments—that the basic research should come under NASA?

Dr. PICKERING. What I mean, sir, is that NASA should direct the program; that a large part of the program may very well be conducted by the military, but that it should be conducted consistent with the plan established by NASA.

Mr. MCCORMACK. That would put the military subject to the domination of NASA; wouldn't it?

Dr. PICKERING. In the area of space research, sir, not in the area of space weapons.

Mr. MCCORMACK. Well, I am not referring to space—well you are referring to the intercontinental ballistic missiles and the intermediate missile now, in particular, I assume?

Dr. PICKERING. No, sir. The missiles I would regard exclusively as the problem of the military and they must indeed solve that problem.

Mr. MCCORMACK. But there could be space weapons in the future which can be projected from a satellite?

Dr. PICKERING. Frankly, sir, I find difficulty in believing this.

Mr. MCCORMACK. I am just a layman and—don't judge my mind by any questions I ask—I am just trying to explore your theory and thinking.

Dr. PICKERING. Yes, sir. Quite clearly I can find plenty of people who will disagree with me on this point, but I personally happen to believe that most of the so-called space weapons systems, if they are going to be weapons systems at all, will be a long way in the future.

Mr. MCCORMACK. Well, we have to be planning for them now, though.

Dr. PICKERING. Sir, I would plan for them by conducting under the NASA—conducting a very active space program which is evolving the technology, discovering how to use them, just as the aircraft was developed first of all as a reconnaissance device and then eventually

as a bombing device; after you had a little experience with it, you saw how to use it. So I would say the same thing is true here, that we need to develop some experience in space, get some instruments, get some men, get some experience in sending things out to space, recovering things from space, and then decide where we will go.

Mr. McCormack. In other words, NASA will do the basic research and farm it out to the military so far as the technology is concerned?

Dr. Pickering. Sir——

Mr. McCormack. On military weapons?

Dr. Pickering. I would say in doing the basic research, I certainly conceive of NASA as conducting the space experiments. Sometimes, when one says "basic research," one thinks of a man in a laboratory sitting around a lot of glass tubing.

But in this case I would regard the research for space as meaning sending vehicles, instruments, men out into space. And developing all the necessary engineering technology to do that.

But there is a difference between sending a man out into space or sending instruments out into space as a scientific experiment or as a human venture and developing a weapons system.

The weapons system has to build on the technology which can be developed through the scientific exploration of space.

Mr. McCormack. Well, would you give NASA control of all basic research in the field of outer space?

Dr. Pickering. Yes, sir.

Mr. McCormack. Both?

Dr. Pickering. Both military and civilian.

Mr. McCormack. Thank you.

The Chairman. Any further questions? Mr. Hechler.

Mr. Hechler. Following out what Mr. McCormack was asking, which I think is extremely important, isn't it necessary to insure that there is at least a military applications unit within this clearly responsible system of NASA which you would like to point toward?

Dr. Pickering. Yes.

Mr. Hechler. I acknowledge that you may possibly be correct in your appraisal of future military uses of space, but can we afford to take that chance? Isn't it vitally important that the military be given the opportunity to utilize what may develop?

Dr. Pickering. Yes, sir.

Mr. Hechler. Shouldn't the military be represented in the space agency, because the type of coordination and cooperation that you have outlined here, I think is not the answer to the question?

Dr. Pickering. Well, sir, I must agree with you that the military must be alert to the possibilities and must feel that they have the right to exploit these possibilities, but it seems to me that this still can be accomplished with a civilian agency establishing the fundamental program, the fundamental research program. Without trying to push the analogy too far, I see some analogy to the Atomic Energy Commission, which indeed supplies the military with what they need and invites the military to put requirements on them—to give them special things, and so forth.

It seems to me that there is a somewhat analogous situation. I obviously cannot push the analogy very far, though, because of the greatly different circumstances in which the atomic energy program was established, vis-a-vis this program.

Mr. Hechler. Isn't there some danger, Dr. Pickering, that if you put the complete control of basic research in outer space under NASA, without sufficient protection of the military, that you may choke off some very essential projects that if not carried forward, might endanger our national security, projects which the military feel are essential and which they cannot convince NASA are necessary?

Dr. Pickering. I suppose it is possible. I think it is improbable, particularly considering the pressures which the military could bring to bear on a situation of this sort—I mean, as a practical matter.

The Chairman. As I understand your position, it is to give to NASA the pure, basic research and then all space research, but to retain in the military the applied science, is that it, especially in field applications of vehicles and weapons that the military might use?

Does that substantially size it up?

Dr. Pickering. I would say that the military certainly has the requirement to develop weapons systems based on technology, research, and general information developed by NASA.

Let me, for example, suggest that in the field of, say—well, land-line telephones—the military obviously has an application for telephone systems of various sorts. They have special requirements on telephone systems. They draw on a great deal of civilian technology here and they just use it.

I would regard this as a somewhat similar situation. Now, again, I cannot push the analogy too far because of the greatly different civilian applications in the one case as in the other.

The Chairman. Well are there any further questions?

(No response.)

The Chairman. If not, then, Doctor, I think this has been a real opportunity to have been able to talk to you here today and to have you from the west coast and we appreciate very much your coming.

Now, if there is no further business, the subcommittees will meet and I hope clean up their work this afternoon and the full committee will meet Thursday morning at 10 o'clock.

(Whereupon, at 11:38 a.m., the committee adjourned to reconvene at 10 a.m., Thursday, February 25, 1960, on another subject.)

REVIEW OF THE SPACE PROGRAM

MONDAY, MARCH 7, 1960

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C.

The committee met at 10 a.m., Hon. Overton Brooks (chairman) presiding.

The CHAIRMAN. The committee will come to order now.

We have this morning as our first witness, in fact, our only witness, Mr. Thomas G. Lanphier, Jr., formerly with Convair.

Now, Mr. Lanphier, under the procedure of these posture hearings, all of the witnesses are sworn. I will ask if you will rise and take the oath: Do you solemnly swear that the testimony you are to give before this committee in matters under consideration will be the truth, the whole truth and nothing but the truth, so help you God?

Mr. LANPHIER. I do, sir.

The CHAIRMAN. Have a seat.

Gentlemen of the committee, Mr. Thomas G. Lanphier, Jr., formerly with Convair, has a most distinguished record, had a very fine fighting record. I think a copy of it is before the members of the committee and I ask that, there being no objection, we place his background and his record in the hearings.

Mr. FULTON. If it is a qualification for appearing as a witness before this committee, I agree.

The CHAIRMAN. You mean the oath?

Mr. FULTON. No: the fighting record.

The CHAIRMAN. Well, he is a fighter.

(The biography of Mr. Lanphier is as follows:)

Lanphier, Thomas G., Jr., aircraft exec.; b. Panama Canal Zone (parents U.S. citizens), Nov. 27, 1915; s. Thomas George and Janet Irma (Cobb) L.; A. B., Leland Stanford U., 1941; m. Phyllis Johnson Fraser, June 6, 1943; children—Patricia Cobb, Judith Fraser, Janet Oliva, Kathleen Charles, Phyllis Ada. Editor for the Idaho Daily Statesman, 1945–49; special assistant to Secretary of Air Force, 1949–50; spl. asst. to chmc. Nat. Security Resources Bd., 1950–51; v.p. Consol. Vultee Aircraft Corp. since 1951. (1951–60). Mem. air staff com. N.G. Policy, 1948–49; mem. sci. adv. bd. to Chief Staff U.S.A.A.F., 1950–51; served as fighter pilot, U.S.A.A.F. South Pacific, 1942–43: dir. fighter operations and tng., 72d Fighter Wing, 1943–45; now col., Res.; comdg. officer, 190th Fighter Squadron, Ida. Air N.G., 1946–49. Decorated Navy Cross; Silver Star with oak leaf cluster, Distinguished Flying Cross with oak leaf cluster, Air Medal, Recipient Air Force award for exceptional civilian service, 1948. Mem. Nat. Aero. Assn. (pres. chmn. bd. 1955), Air Force Assn. (pres. 1947–48, chmn. bd. 1951–52), Kappa Sigma, Sigma Delta Chi. Clubs: Circumnavigators (N.Y.C.) La Jolla Country, Cotton Bay, Winged Foot Country. Howe: 203 Via del Norte, La Jolla, Cal.

The CHAIRMAN. Now, I understand, Mr. Lanphier, that you have a prepared statement and we will be very happy if you will proceed

with the prepared statement as you have it, following which we wish to ask you some questions.

STATEMENT OF THOMAS G. LANPHIER, JR.

Mr. LANPHIER. Thank you, Mr. Chairman, and my apologies for the fact that copies of this statement have not yet arrived. They are somewhere en route through the halls.

The CHAIRMAN. When they come we will distribute them.

Mr. LANPHIER. All right, sir. I would like to thank the chairman and the committee for the honor and the invitation to present my views as an American citizen on the national space program and what I consider to be the perilous state of our national defenses over the next 3 years.

As background for my remarks, I would observe that for the past 20 years, I have, like many others, been associated in one way or another with the defense effort of the United States.

For more than the past decade, I have been directly associated, in the Pentagon, in the White House, and in industry, with the development of weapon systems of the hydrogen bomb and ballistic missile era. Throughout this period, I have held a top secret clearance with the Pentagon and a "Q" clearance with the Atomic Energy Commission.

For the past 9 years, I have worked with Convair, one of the Nation's largest and most versatile defense contractors. Convair is a division of General Dynamics Corp. which, in its Electric Boat Division, also builds nuclear submarines for the Polaris weapon system.

As Convair's long-range planner, I have, over the years, participated in the conception, development, and production of supersonic-manned interceptors and antiaircraft missiles for our air and fleet defense, and have been similarly employed on our nuclear bomber, supersonic-manned bomber and Atlas ICBM programs for this country's retaliatory forces. Also, during the past several years, with the advent of the Atlas as the bulwark of the national space program, I have had considerable participation in the long-range planning for some systems in this field.

Throughout this past decade, and particularly over the past 5 years, I have watched with growing concern the perennial development of defense budgets more and more out of joint with the technological times and less and less sufficient to meet the growing threat in the significant areas of ICBM's, antisubmarine warfare, and limited war deterrent.

Three years ago, Gen. Curtis LeMay testified before Congress to the effect that unless our defense program changed from what was then planned, the winter of 1959–60 could find us inferior to Soviet Russia in modern military power.

In the intervening 3 years, the only changes in our own defense effort have been to diminish it from what is was then planned to be. The Soviets, meanwhile, have led mankind into space with their Sputniks.

Last spring, along with the rest of the world, I heard President Eisenhower admit by implication that we could not meet the Berlin crisis, if force were required, with any alternative but national suicide.

This winter, in the defense budget he has proposed to the Congress, I note with disappointment that the President has proposed no significant step toward arming us with a limited war deterrent for use in the continuing crisis over Berlin and other, as yet unforeseen, but certainly potential limited war situations.

I note he has again asked for insufficient ballistic missile and manned aircraft to close the growing deterrent gap relative to Soviet Russia in the area of massive weapon systems.

And he has once again read the United States out of the space race while failing to take the simple steps currently possible to better organize the space programs the United States does have underway.

Altogether, I believe my country's defense forces and policies have been allowed to drift to the paradoxical point in time when the President can rightly say the strength of our Armed Forces is incalculable and could destroy today any aggressor: and at the same time by this paradox, I can validly say my country may this winter be in the process of losing world war III.

I believe we are losing world war III for, among other reasons, lack of a sufficient and timely ICBM program, lack of a defense against a submarine attack, lack of an adequate civil defense program, lack of a weapons program and policy to deter limited aggression, lack of a sufficient and timely space program and, above all, lack of recognition that we are and have been for a long time, actually been engaged in world war III.

We are engaged, in fact, in the only military phase of world war III we have a chance to win: the deterrent phase. And we are losing it. Losing it to the extent that I believe we could now logically assume ourselves to be in jeopardy of physical destruction and likely to remain so for the next 3 years.

This because modern weaponry, in the hands of the Soviet Union, can be assumed to have reached a qualitative and quantitative point at which our "incalculable power" to destroy an aggressor can now be itself destroyed, in the main, in a matter of moments.

A revolution in arms has occurred on both sides of the Iron Curtain over this past decade. A revolution not yet thoroughly recognized or acknowledged at the policy levels of the executive branch of our own Government but disturbingly recognized and exercised in the Kremlin.

In the course of this technological revolution in arms, it is worth noting that the scientists, the engineers, and the producers of ICBM's and other ultramodern weapons have moved up alongside the uniformed men of the armed services as combatants in the conflict against communism.

Those in science and industry who are responsible for the continuing invention of weapon and space systems timely enough and effective enough to add to the deterrent, can and do take pride in their contribution to the defense effort.

Men of science and industry deserve better recognition than they generally get for the major role they play in maintaining the quality of the deterrent force in being. They also should be afforded readier access to such information as our intelligence sources may have developed regarding experience in similar technological fields on the other side of the Iron Curtain.

In regard to the momentary effect of the arms revolution which is occurring, General Power, commander of the strategic air arm, has recently said:

> According to released data on nuclear effects, it would take an average of three missiles, in their current state of development, to give an aggressor a mathematical probability of 95 percent that he can destroy one given soft target some 5,000 miles away. This means that, with only some 300 ballistic missiles, the Soviets could virtually wipe out our entire nuclear strike capability within a span of 30 minutes. To further heighten this threat, only about half of these missiles would have to be ICBM's. The rest could be the smaller IRBM's which are considerably less expensive and easier to produce.

There are those, including myself, who believe General Power is conservative when he estimates it would take as many as three ICBM's to destroy a soft SAC base and all the retaliatory bombers on it. There are others who argue it would take more. But it is difficult to understand how anyone can argue when he says:

> We must anticipate that the Soviets may have accumulated a sufficient number of operational ICBM's and IRBM's for an allout missile attack before we have in operation warning systems which could provide reliable and adequate warning of such an attack. We have such systems now under development designed to give some 15 minutes warning, which would suffice to get most or all of SAC's ground-alert forces airborne. But until our ballistic missile warning system becomes fully operational, SAC's capability to survive a missile attack with little or no warning will be the crux of the free world's deterrent posture.

Yet this winter's budget for our defense does not ask for enough money to keep a significant number of SAC bombers and bombs off the ground and out of the pouncing reach of Soviet ICBM's. An ICBM force which could well be, by this time, more than the 150 Soviet ICBM's General Power opines would be required to wipe out our retaliatory force.

There is no great mystery about the point General Power is trying to make. Including our carriers at sea and our advanced SAC bases overseas, there are less than 100 points—most, in fact all of them, outlined in this published manual.

The CHAIRMAN. What is the manual you refer to?

Mr. LANPHIER. It is called Air Force bases. It describes—I won't add up the total, I understand that is a classified number—but it describes in detail where these bases are, what facilities are on them—I am not being facetious.

The CHAIRMAN. Who wrote the book?

Mr. LANPHIER. The Military Service Publishing Co.

The CHAIRMAN. It is a current publication?

Mr. LANPHIER. Yes, sir; it has a valid purpose. It is to inform troops or whoever are moving to some of these places how far they have to travel, and so on, but you just look at the other side of the coin and all I am saying is it outlines, as of late 1958, with the exception of what new military bases there are, where SAC is deployed.

Mr. MCCORMACK. In order to clear the record you are not criticizing that publication?

Mr. LANPHIER. No, not at all. The only point I am making is there is no mystery about how many of these aiming points there are, certainly not to the Soviets.

The CHAIRMAN. Your idea is that that gives the Soviets the information?

Mr. LANPHIER. No, what I am saying is there are less than 100 bases that they have to shoot at, upon which our retaliatory forces are established, that they have to shoot at as their problem in destroying our retaliatory force. I am simply taking this as my source that there are less than 100, this book, that is all.

The CHAIRMAN. Just proceed.

Mr. LANPHIER. There are less than 100 points at which the Soviets must aim their ICBM's or submarines in order to destroy our retaliatory power. And in a technological era when we ourselves have nuclear submarines which can outrun our current carriers and have an ICBM which can be delivered half-way across the world and by the President's own admission, strike within 2 miles of its target, it is certainly within the realm of logic to assume the Soviets may have submarines and ballistic missile forces of equal quality and considerably greater quantity than do we.

Any less assumption as the basis of our defense planning in this age of final weapons is unwarranted.

In World War II, Pearl Harbor came upon us at a speed of about 200 miles an hour from an altitude of about 10,000 feet, and we had, in effect, 2 to 3 years' warning time with which to retaliate. This time it might come at thousands of miles an hour, fired from out of the atmosphere, but more likely the Pearl Harbor of world war III may well be quietly occurring this winter as we drift past that moment in our national planning when we could have maintained a defense force impressive enough to continue to deter the Kremlin from overt physical aggression or unanswerable political ultimatums.

Again, borrowing from General Power, about 30 years ago at the Lenin School of Political Warfare, a member of the committee of the Communist Party told the students:

> War to the hilt between communism and capitalism is inevitable. Today, of course (that is, in 1931), we are not strong enough to attack. Our time will come in 20 or 30 years. To win, we shall need the element of surprise. The bourgeoisie will have to be put to sleep. So we shall begin by launching the most spectacular peace movement on record. There will be electrifying overtures and unheard-of concessions. The capitalist countries, stupid and decadent, will rejoice to cooperate in their own destruction. They will leap at another chance to be friends. As soon as their guard is down, we shall smash them with our clenched fist.

All things concerned, our guard is now down. We are, as predicted, cooperating in our own destruction. We are being put to sleep.

To the extent I can cry alarm, with my own individual voice, I propose to do so. And in order to unclutter my opinion from charges of bias, I am regretfully leaving the great company of which I have been a part for almost a decade. This in order that its important programs and my own opinions not encumber one another.

Thank you again for your gracious invitation to hear my point of view.

The CHAIRMAN. Mr. Lanphier, that is a very, very strong statement, and I notice that you follow the views of the head of our SAC Air Force in quoting him in a number of occasions with favor. I want to say first to the members of the committee that we are proceeding this morning under the 5-minute rule that we adopted some time ago.

Mr. FULTON. Mr. Chairman, can I comment?

The CHAIRMAN. Yes.

Mr. FULTON. Just a minute, Mr. Riehlman.

When there are this number of charges of very grave nature on everything from ICBM's to submarines to defense posture to criticism of the Executive, it will be impossible for me to uphold the negative in 5 minutes. Mr. Riehlman has another meeting he must go to.

The CHAIRMAN. Mr. Riehlman will be back though, and Mr. Van Pelt is going to be here.

Mr. FULTON. It will be impossible to meet these things in that period of time. I will be very willing to step aside so that originally the 5-minute rules shall go down the committee. But then I will need more time than 5 minutes obviously to meet such exaggerated charges as this, because this looks to me like one of the best prophets of doom and disaster in the last 10 years, and I would love to have just a little more than 5 minutes with him.

The CHAIRMAN. The gentleman, I think, was the one who made the motion to adopt the 5-minute rule. I am merely carrying out the mandates of the committee. This morning it so happens we have this witness here, and at noon we have a bill on the floor of the House of Representatives. So far as the chairman is concerned, he would be very glad to extend this, but with the members present I don't think it would be fair to deny some of the members sitting further down the ladder an opportunity to question. We can run until noon, and after 5 minutes by each member is completed, and if there is any time left, we will go around again until noon is here.

Mr. FULTON. That is what I meant; after the other members are completed, I meant to take some time.

Mr. MILLER. How are you going to divide that extra time?

The CHAIRMAN. The extra time——

Mr. FULTON. I move, then that the time be divided 50 percent on each side of the House this morning, as it will be impossible for one member sitting here on the Republican side to answer all these charges in 5 minutes. I am sure there is no intent to shut the Republican side off.

The CHAIRMAN. I don't think it is our purpose to answer charges here this morning. We are here to hear the witness now. If he wants to make charges, we can answer the charges on the floor there.

Mr. FULTON. I think he has already made very serious charges.

Mr. WOLF. Perhaps we could have some phone calls made to the Republican members of the committee and they could come down.

Mr. FULTON. I think you will find I can use enough time.

The CHAIRMAN. What the Chair proposes to do is this: We are going to proceed under the 5-minute rule. We have lost nearly 5 minutes already. When we go around if there is any time left we will proceed again under the 5-minute rule for a second time. I will recognize members alternatively on each side. Mr. Fulton can get the other members, if he wishes to, on his side to be in attendance here. That is their responsibility.

Mr. FULTON. May I make this suggestion, that when we come to the second time around, that in accordance with my request that I be given more time?

Mr. MILLER. No; I don't approve of that. We have the rule.

The CHAIRMAN. You have heard the motion; Mr. Fulton wants more time.

Mr. MCCORMACK. Have you made a motion?

Mr. FULTON. I requested that of the chairman.

The CHAIRMAN. You haven't made a motion. I was going to have it voted on. If there is no motion before the Chair——

Mr. MILLER. I think the point of order is out of order.

Mr. FULTON. I just requested the chairman.

The CHAIRMAN. We will proceed as indicated.

Mr. Lanphier, coming back to your statement, will you give us more specifically something that you have in mind?

Now, wherein can we move to improve this situation according to your ideas and be specific? Is it in improving our airplanes, is it in producing better missiles, is it in keeping them alert in the air constantly as General Power says or what is it?

Mr. LANPHIER. It is a combination of these, sir. I would say that about three——

The CHAIRMAN. Name them—1, 2, 3.

Mr. LANPHIER. Right. The first thing I would say that is most essential is a reorientation of the national attitude about the fact that we are being warred upon, and a candid assessment of that fact by the President, and a candid assessment by him of the relative values of our deterrent versus theirs.

Our deterrent is certainly not effective in terms of what we think it is but, more importantly, what Mr. Khrushchev and his people understand it to be. So I don't really see too many reservations about talking about the power that we do have in more practical and specific terms than has been practiced so far at least.

No. 1, a change in the national attitude, hopefully engendered by the President.

No. 2, a rearrangement of this budget and all future budgets oriented toward and related to the threat and begun, say, in the summer, for future budgets with an establishment of what the estimate throughout the administration is of the threat in its several forms, both in the minds of the people who are compiling the budget in the Defense Department and then the Congress, which is going to have to review it later in the winter.

In terms of immediate action in this budget, I would suggest that whatever funding is required, to get a significant element of SAC in the air as soon as possible, be allocated.

That more tankers, KC–135's, both for the current and for the next 2 or 3 years—rather for the next 2 or 3 years; you can't do anything about the current one—be procured both for the airborne alert and for possible retaliation.

By all means accelerate both the Atlas and the Titan programs, each of which can be accelerated. I know more about the Atlas program and I know that one can be accelerated to a significant degree by the end of 1962 and into 1963. At the moment there is no acceleration planned for it and it is planned to terminate in 1962.

Accelerate both the Polaris and Minuteman mobile systems. There is a tendency on the part of the people bespeaking the administration's point of view to imply or rather you can infer from their conversation about the Polaris and Minuteman that they are much sooner

available in a reliable and operable form than they are actually scheduled to be.

And again, anybody in this business has got to factor the stated schedules for these two mobile systems as against the experience that we have had in the industry over the past 10 to 20 years.

For instance, the Atlas, leaving apart the first 7 years when it was in a fairly reduced state of activity, but beginning about 1954, when it was accelerated, to this moment is 6 years. At one time it enjoyed sole priority and the maximum priority given a weapons system in peacetime in this country. Even with that, in this the sixth year, it is just becoming qualitatively operational and is still some time away from being quantitatively operational.

When you relate the schedule on the Polaris which began on a relative point about 3 years ago, to be operational as a system this year or next year, this stretches the credulity of professional people in the business and doesn't seem to me the basis for a valid defense plan by the administration unless there is a considerable around-the-clock acceleration of both these programs, which there could be if the attitude were changed.

I would suggest by all means accelerating the two space programs with which we aspire to warn ourselves, Midas and Samos.

I would suggest the procurement of more B–52's and B–58's since they are going to begin to wear out after a couple of years of airborne alert, since we have in the B–52 a known instrument and in the B–58 an easily dispersed quick-reacting supersonic bomber.

I would begin to buy airlift for the Army and Marines, something which we haven't done in any budget in the last 5 years to any noticeable degree.

I would go ahead with the B–70 as a development program and a version of the B–58 currently being discussed in the Pentagon, each as entries, one before the other, in the manned retaliatory system field. And by all means, I would engender a sensible civil defense shelter program as a very significant element of the deterrent. Something we don't now have. Something the Soviets most certainly do have.

On the long-term basis, I would make quite certain that the space program which, at the moment, at least to the extent of the opinion of the people throughout the organization with which I work, which is fundamentally involved in the space program with the Atlas and others, is a well-considered program. But I would make most certain with dollars that the program is adhered to and that it is by far better managed than it currently is in its several forms.

By this I mean that in each instance it is being well enough managed to the extent it can be in the Defense Department and the civilian agency, but the integration of the efforts on the part of people who invent things and try to find a place to submit them and have them accepted in time to be useful is still a complicated thing. There is no——

The CHAIRMAN. Mr. Lanphier, I am a victim of my own rule. My 5 minutes are just about up.

Mr. LANPHIER. I have about finished mine, sir.

The CHAIRMAN. Summarizing what you have to say, and you can answer this "Yes" or "No," the burden of what you have to say is

that we give all of these things that you referred to the highest national priority, that you add more funds to them and step up our defense program in the points that you have indicated?

Mr. LANPHIER. Yes, sir.

The CHAIRMAN. Isn't that it?

Mr. LANPHIER. Yes, sir.

The CHAIRMAN. Mr. McCormack?

Mr. MCCORMACK. Mr. Lanphier, fortunately we are living in America which is a land of free speech. Of course, you are appearing here, you are presenting testimony for our consideration and for other committees you may appear before. I appreciate your courage and all and I make a general observation to you as well as any other American, that if your conscience and your judgment tells you that our country should be better prepared, no matter what is said about you, I hope you will carry on.

Mr. LANPHIER. Thank you, sir.

Mr. MCCORMACK. Now, as I remember the first Sputnik was launched about 2½ years ago, is that correct?

Mr. LANPHIER. The first and second one within a month of each other, yes, sir.

Mr. MCCORMACK. You are acquainted with the Atlas?

Mr. LANPHIER. Yes, sir.

Mr. MCCORMACK. Confining my remarks to that and not leaving out the Titan or any other long-range ballistic missile, can the Atlas, the long-range ballistic missile now in production put up a payload today as big as the Sputnik did then?

Mr. LANPHIER. The first Sputnik was about 180 to 200 pounds, I believe, the payload. The Atlas could have done that beginning about last May, a year and a half later than the first Sputnik.

The second one, however, the big one about 3 weeks later, something about 1,200 pounds payload, we cannot today put up an equivalent payload unless we are allowed to go ahead with the advanced version which we are discussing with the Pentagon at the moment.

Mr. MCCORMACK. If the United States had launched an Atlas—I am confining it to the Atlas—the size of the first Sputnik of 2½ years ago, would that have satisfied you as a missile maker, that the United States could proceed with the production of an intercontinental ballistic missile?

Mr. LANPHIER. Yes, after those two shots, yes.

Mr. MCCORMACK. Say in those 2 years since then, how many ICBM's could have been produced?

Mr. LANPHIER. In our plant, the one plant?

Mr. MCCORMACK. Yes, or in all plants, say on a full-week basis.

Mr. LANPHIER. Had we launched those two Sputniks and been in that position 2½ years ago with our one facility we could have by now, working a 6-day week, the way the Russians do, we could have 250 missiles. And we could have 150 more through the past year in any one of several other plants, two or three I can think of, had we been commissioned to subcontract to them.

Mr. MCCORMACK. With that development, is it easier to produce the missile?

Mr. LANPHIER. Yes, sir, interestingly enough. It takes less people once the missile is developed, yes, it takes less people and space to

manufacture it than it does to make a supersonic fighter, for instance, right alongside it in San Diego.

Mr. McCormack. Based on the missile production experience you and your company have had with the Atlas, do you believe that the Soviets, starting from the Sputnik experience of some 2½ years ago, could have produced several times the number of intercontinental ballistic missiles—I think General Power said 150 January 19 or thereabouts, as I remember——

Mr. Lanphier. He said 150 ICBM's.

Mr. McCormack. Necessary to destroy our retaliatory force in case we were attacked.

Mr. Lanphier. Yes, sir; if we had started when they did and had the experience that they had evidenced by the Sputniks in development to that point, we could have, yes, three times 150, we could have somewhere between 400 and 450, working a 6-day week—with another attitude about it, though.

Mr. McCormack. Our next generation is the Minuteman, isn't it?

Mr. Lanphier. The next ground based; yes, sir. The mobile systems come along sometime in the next 2, 3, 4 years, the underwater Polaris and the above-ground Minuteman. When they arrive, then they do become—this is the reason for the concern about the next 2 or 3 years until they do arrive—when they arrive and are mobile, therefore, harder to find and requiring that many more missiles in the enemy's inventory before he is sure he can successfully attack or destroy us.

Mr. McCormack. What you seem to be concerned about is that gap of the next 2 or 3 years?

Mr. Lanphier. Yes, sir; before those things arrive and while the Soviets still have this outlandish superiority in numbers of these missiles over our combination of missiles and bombers on the ground. And in that interim the only alternative I can see is to get the bombers off the ground so they cannot be pinned down. That means they have to have more numbers, force them to build more missiles.

Mr. McCormack. That is all.

The Chairman. Mr. Fulton.

Mr. Fulton. Will somebody tell me when that clock up there hits 17 of?

The Chairman. Mr. Miller will keep us informed. He is timekeeper.

Mr. Fulton. All right.

Mr. Lanphier, I have read your statement. Do you have any engineering or technical degree? I see none.

Mr. Lanphier. No, sir.

Mr. Fulton. So you are really a newspaperman because you were in the newspaper business in Boise, Idaho, aren't you, basically?

Mr. Lanphier. I was there for 4 years; yes, sir.

Mr. Fulton. Yes. Then you went in as consultant to Senator Symington in 1949 and 1950?

Mr. Lanphier. That is right.

Mr. Fulton. The question then comes, Were you a 48-group Air Force man or the 70-group? Were you against Harry Truman and against Symington and were you out on your own then screaming we were going to be in a war very quickly in 1950, or were you one of the silent ones who had his eyes shut and did your duty?

Mr. LANPHIER. Do I answer all these questions in sequence?

Mr. FULTON. You say which one of those you were, a 48- or 70-group man.

Mr. LANPHIER. I was for the maximum that could be achieved at the time.

Mr. FULTON. You didn't say it, but you were loyal to Symington and Truman on the doctrine then, weren't you?

Mr. LANPHIER. Mr. Fulton——

Mr. FULTON. Just say yes or no.

Mr. LANPHIER. I beg your pardon——

Mr. FULTON. Then explain, then explain——

The CHAIRMAN. The witness is going to have to answer the question as he sees it.

Mr. FULTON. I am asking the witness the question. Nobody else in the room is, up until this point, and the fact he wasn't buying enough airpower. The question is, Did you disagree with Symington on the 48- to 70-group Air Force when he said a 48-group Air Force was all right?

Mr. LANPHIER. I don't recall his saying that. You have the advantage of me citing history.

Mr. FULTON. Did you know Mr. Symington resigned because he couldn't say it publicly but he felt a 48-group Air Force was not enough to protect this country?

Mr. LANPHIER. This was my impression.

Mr. FULTON. Which side were you on on that?

Mr. LANPHIER. The same side.

Mr. FULTON. Thank you very much. The next thing in 1949 and 1950 we really had no missile program. If that is the case, you say right today if we had started when the Russians did, we would be right up to them and there would be no gap.

Why didn't we have a missile program? Why did you people shut it off in 1949 and 1950, because if we had started when the Russians did we wouldn't have this prospective gap. Aren't you a little to blame, too?

Mr. LANPHIER. The missile gap, the cessation of ballistic missile activity occurred before 1949 or 1950, it was 1947 or 1948.

Mr. FULTON. In 1949 or 1950 the program——

Mr. LANPHIER. At the time I arrived in the Pentagon the concern was they had so many dollars for missiles. They decided to go ahead with the Navaho. They decided to go ahead with the air-breathing Navaho which, thank God, they did because from that source came the engines for the Atlas and Jupiter and Thor.

Mr. FULTON. We have three Air Force Atlas missiles in operation?

Mr. LANPHIER. Two.

Mr. FULTON. We have Cape Canaveral, we have Vandenberg for ICBM's, so we have two launching bases. Russia has one, don't they? So we have twice as many as Russia?

Mr. LANPHIER. In the first place we have one operational launching base, Vandenberg. I won't conjecture on the Russian side of it.

Mr. FULTON. With Russia only having one——

Mr. LANPHIER. You can hardly call Canaveral an operational site.

Mr. FULTON. It could be.

Mr. LANPHIER. Not in modern terms when the only thing you can consider is a 15-minute reaction. The answer is, therefore, "No."

Mr. FULTON. We are getting short on time. On the book "Air Force Bases" that was published in July 1958 the copyright was taken out. It evidently, according to your statement, says there are 100 bases.

Mr. LANPHIER. No, sir; I say there are less than 100.

Mr. FULTON. Have you read any Foreign Affairs Committee reports or any testimony we have put out showing there are 250 bases that the United States has abroad for our defense?

Mr. LANPHIER. No, sir.

Mr. FULTON. Have you read any of those?

Mr. LANPHIER. No, sir; I am talking about the bases from which retaliation can be visited upon the Soviet Union. There are less than 100 of them.

Mr. FULTON. You don't think 250 bases we have abroad together with our allies are to be taken into consideration because if you don't——

Mr. LANPHIER. Not significantly.

Mr. FULTON. Why then you are already off base by 150?

Mr. LANPHIER. No, sir.

Mr. FULTON. You were over 50 percent in error to begin with in our defense capability?

Mr. LANPHIER. One of us is.

Mr. FULTON. That is all.

Mr. LANPHIER. One of us is mistaken.

Mr. FULTON. I suggest it is you because, if you have read no Foreign Affairs Committee reports on it, I think you are really ill-informed to come before us without an engineering degree and try to tell us what to do.

The CHAIRMAN. That doesn't require an answer. It is a voluntary observation.

Mr. FULTON. Is it 17 of yet?

The CHAIRMAN. Mr. Miller?

Mr. MILLER. I have an engineering degree, Mr. Fulton, but I haven't used it and I hate to put my knowledge of engineering that I haven't used since World War I up against Mr. Lanphier. So I want you to know, Mr. Lanphier, I do have a degree.

Mr. WOLF. The press can't hear the comments of our distinguished colleague from California.

Mr. MILLER. That is all right. That is immaterial to me and I am not making it for the benefit of the press. [Laughter.]

Mr. Lanphier, you speak of needing an airlift, and a number of other things. Would you include in the all-out preparation that this country must have also an adequate merchant marine to serve our troops and to service our people if we have to fight abroad?

Mr. LANPHIER. Not in the immediate sense, no sir, not in this kind of a war, I don't believe so. We certainly can use that in support of a limited war deterrent to some degree.

Mr. MILLER. Why do we need an airlift then if we can't supply them?

Mr. LANPHIER. The airlift does the supplying, sir.

Mr. MILLER. From what I understand, it will be almost impossible to supply.

Mr. LANPHIER. No, sir, we have run exercises for the Marines in years gone by.

Mr. MILLER. You can do it?

Mr. LANPHIER. Yes, it can be done, it can be done more economically than with surface ships.

Mr. MILLER. I question that.

Mr. LANPHIER. This was our conclusion.

Mr. MILLER. Yes. The thing I want to get to is we have talked about Polaris. Isn't Polaris the missile that is furthest along right now?

Mr. LANPHIER. You mean it is the most advanced in concept?

Mr. MILLER. Most advanced.

Mr. LANPHIER. I would say of the four missiles, Atlas, Titan, Minuteman, and Polaris, it is a different version of the Minuteman, but it is certainly one of the two most advanced.

Mr. MILLER. After all, if you are going to drop an atomic warhead, the vehicle that carries the atomic warhead is incidental, isn't it, it is a question of getting the warhead where you want it?

Mr. LANPHIER. Yes, sir, but the vehicle is most pertinent.

Mr. MILLER. Very important, but it is incidental if it can get the warhead there?

Mr. LANPHIER. Yes, sir.

Mr. MILLER. Isn't it our most advanced means? The things——

Mr. LANPHIER. It will be one day. That is my point. It is still sometime down the road.

Mr. MILLER. Isn't it much closer than anything else we have?

Mr. LANPHIER. Not closer than the more definitely established Atlas and Titan. My point is we could use a considerable number of those in the next 2 or 3 years while these other systems are coming on.

Mr. MILLER. I agree with you. But I was also looking through General Medaris' statement here where he suggested that we could perhaps get away with a few of these and he pointed out we did have Polaris and Polaris was much further along than some of the others and perhaps some concentration—at least we fired the last 21 Polarises very successfully.

Mr. LANPHIER. Yes, sir, it is moving along beautifully in this development program. My point is on the basis of hard-boiled experience, you have got to assume as complicated a system as this isn't going to be qualitatively reliable for a considerable period further down the road than seems to be the impression, something you can rely on for your country's defense.

Mr. MILLER. I think we can be lulled into a false sense of security, we haven't——

Mr. LANPHIER. When we have it, it is going to be a most useful system, but it, like other systems we are talking about, is not going to be the complete answer.

Mr. MILLER. I am talking about missiles generally, not limited to Polaris.

I mean you have got to have this as the gun that you can most rely on perhaps a little quicker than anything else and perhaps it should be developed. How do you feel about the defensive system, Nike-Zeus, do you think we should go into that?

Mr. LANPHIER. Defense against attacking forces at any given moment is the toughest job of all weaponry. Even today our chances of defending against a manned air raid, I mean a manned bomber

raid, are not considerably greater than they were in World War II, when the Germans averaged 4 or 5 percent.

The Nike-Zeus, I don't think is pertinent to the problem at all, no, sir.

Mr. MILLER. Do you think we should spend time and money and effort on defense system?

Mr. LANPHIER. Yes, as an element of deterrence, not to completely defend us. The Nike-Zeus just doesn't happen to be one I technically agree with, however. The approach should be maintained toward defending against ballistic missiles.

The CHAIRMAN. The gentleman's time has expired. Mr. Osmers, do you want me to call on you now or would you rather for me to pass——

Mr. OSMERS. I would like to yield to Mr. Fulton for a question.

The CHAIRMAN. I will recognize Mr. Osmers at this time.

Mr. OSMERS. All right, I yield to Mr. Fulton.

Mr. FULTON. The National Rocket Club had been before us and their representative had said it would take $4 billion more a year in the Federal budget for space. You have many more things to add to your proposal so yours would obviously cost much more than the $4 billion simply for space than the National Rocket Club recommends.

How much would your proposals cost in the budget, $5 billion, $10 billion, or do you think the National Rocket Club is too high on $4 billion for space?

Mr. LANPHIER. I have proposed no new programs here, I have proposed accelerating a number of them.

Mr. FULTON. How much would it cost?

Mr. LANPHIER. In that respect, I would say it would cost somewhere in the order—to do the various things I am talking about—in this next fiscal budget, $4 or $5 billion.

Mr. FULTON. And it would continue at that rate for the next 4 or 5 years?

Mr. LANPHIER. Oh, yes.

Mr. FULTON. Do you have any idea as to your future, because some of us would like to make sure that yours is not the first shot heard around the world in a third world war preventive campaign but possibly a political campaign for a man named Symington, I would——

Mr. ROUSH. A point of order. I had understood the 5-minute rule to prohibit us yielding time to another member. And the gentleman behind me yielded for the purpose of a question.

The CHAIRMAN. The gentleman is correct.

Mr. FULTON. Do you yield further?

The CHAIRMAN. The rule permits yielding for one question and not the entire time.

Mr. ROUSH. A question to the witness or to the member?

Mr. FULTON. It is up to the member. Do you yield further to me?

Mr. OSMERS. I yield to you to complete your question.

Mr. FULTON. All right. Would you answer that, please?

Mr. LANPHIER. You asked two questions——

Mr. ROUSH. Point of order, the question has been asked and answered.

The CHAIRMAN. The gentleman is correct about it. The rule, if the committee wants to stick to it, the rule is that the time as a block

shall not be yielded from one member to another, but that you can yield for an individual question. Now, when the gentleman yields consecutively for one question after another, he is doing what the rule prohibits him from doing.

Mr. FULTON. Do you adopt that question for me and have it read in your name, please?

Mr. OSMERS. Mr. Chairman, on my own time and my own question, I might say that in common with the gentleman from Pennsylvania, I, too, have some curiosity about the witness' plans and motives and objectives and if the witness cares to tell the committee, we would be enlightened by the answer, and if he doesn't care to answer the question, we will be enlightened by his failure to answer it.

Mr. LANPHIER. There were two questions, I believe, implied or asked. The first question, what am I going to do, myself?

I have not yet decided except that for the next 2 or 3 months as long as my dough holds out, I am going to write and talk about this subject to the extent that people allow me their ear. I will then go to work—I have five children and a wife—at whatever job looks best to me—outside the defense business—looks best to me at the time.

As to Senator Symington, I have known him for about 15 years, I admire him second to no other in terms of his prosecution of the Nation's interest in the defense area. I have worked with him in years gone by and been proud to do so. His views and mine coincide. Neither one of us thinks for the other if that is your implication.

I most certainly am not going to work with Mr. Symington on his staff or whatever—if this is what the implication is. I want to continue to disassociate myself from both Convair, from Stuart Symington, and from anybody else as to what I believe or say on this subject which I think is so critical.

Mr. OSMERS. You have gone into the subject in some detail. I suppose it would become fair to ask you whether you support Mr. Symington for President?

Mr. LANPHIER. He hasn't been nominated yet.

Mr. OSMERS. I didn't ask you that.

Mr. LANPHIER. If he is nominated, I most certainly will.

The CHAIRMAN. The gentleman's time has expired. Mr. Sisk.

Mr. FULTON. Very good. Touché.

Mr. SISK. Getting down to specifics that this committee might be able to act on, do you have any suggestions to make to this committee in connection with our space program, and I would like for you to confine this to the space program as such?

Mr. LANPHIER. Yes, sir, and here my views, as ones I have expressed previously, are a compendium of the ideas of a lot of talented men with whom I have worked for 9 or 10 years in these various fields of supersonic aircraft, ballistic missiles, and space systems. If I may, I will actually read the general position I hold, after sitting and watching these men and working with them as the planning guy for the company for the last 3 or 4 years, in two respects.

In the first place, I would say that the space program as it is outlined for the next decade makes good sense for the United States, if it can be adhered to, if it isn't chipped away at budget after budget as has been the case in the last 2 or 3 years.

As I observed a little earlier, the organization of the moment doesn't encourage getting the job done in space. There is a nonmilitary requirement in space and a concurrent definite requirement for military space systems, each of which is equally important, neither of which should necessarily contradict the other, but at the moment they are not coordinated by any individual in the Government, and they should be.

This would be the No. 1 suggestion I have, that someone at the National Security Council level, an individual with a small staff and the power of decision, be responsible for the coordination and continuation of efforts of NASA and military requirements of the Nation.

In terms of specific programs, the only program that I would suggest be considered over and above what is currently being considered is one called Centaur, which we already have a contract for, that is, Convair does, with NASA, as compared with the effort that is going into Saturn.

Saturn is a requirement for monstrous effort in space, big packages down into the future. However, there is a definite requirement, and it can be met in the next 3 to 4 years, for somewhat smaller packages within the area of the Earth's orbit area by the Centaur program which at the moment isn't being considered for that purpose.

Other than this, I have no suggestions other than the basic one; that is, that the program as it is bespoken at the moment be adhered to, be underwritten by the money it is going to cost, and it is going to cost more money than we are talking about in this budget.

Mr. Sisk. Thank you. The next subject is a little different. I am very definitely in agreement with some statements you make in here with reference to this attitude of complacency that has been created in America today. I am quite concerned about the fact that I do not think that the people understand the necessity of putting their shoulder to the wheel. I want to read just an excerpt from an actual letter here which happened to fall into my hands, and ask you to comment on whether or not this is an attitude in the plant in which you were previously employed. This happens to be an atmosphere in a plant within the same general area, and I might say I am happy to see people well treated, of course. But just to quickly quote from this letter before my time runs out:

> Just thought you might be interested to hear about the "country club" I stumbled upon to work in. It is quite fantastic. I still can't quite believe it all. Everyone here is on a first name basis, according to company policy, no matter if it is the corporation president or a Ph. D. talking to the janitor. There are tremendous jugs of free coffee stationed at intervals in all buildings, made fresh twice a day. The hours are 8 to 5, but it is perfectly all right to come in at 8:30 and leave at 4:30 and still get paid for a full day. It is OK to call nearby toll areas and talk unlimited time, which would run up a huge phone bill on a private phone, but there is no personal expense. Almost all the typewriters are electric and they even have electric staplers. The company cars have radios and four safety belts. The lunchroom operates at cost, so it is very pleasant to load up a plate with goodies which should be way over $1 and have the girl ask for 40 cents. They apparently have nurses who dispense all types of free pills. And you can join anything from chess clubs to volley ball on the beach groups. There is a $10,000 life insurance policy paid by the company, and they offer dozens of staff training courses plus pay for any university courses you take on your own. I am in a group of new trainees who are all in a daze over the kid glove treatment here. This employee procedure is handled by a

group of psychologists who have produced a very satisfied and cheerful group of workers. Until our security clearances come through, we attend classes on company policy and also other classes on more specific work done here at (blank).

And this goes on at——

Mr. LANPHIER. Does this outfit do much business with the Pentagon?

Mr. SISK. This outfit is exclusively financed so far as I know, by the Federal Government.

Mr. LANPHIER. Each of us who works for the Pentagon usually has a pretty tough Navy or Air Force officer and staff overseeing our contracts. To the extent people are happy I don't object to this. I trust that is not Convair you are talking about.

The CHAIRMAN. The gentleman's time has expired.

Mr. FULTON. Do you have——

Mr. MITCHELL. I would like to say to my good friend from California that I am going to be looking for a job after the first of the year and I want him to pass on the name of that company to me.

Mr. LANPHIER. I am afraid we don't have those benefits at our place, all of them.

Mr. SISK. Would the gentleman yield?

Mr. MITCHELL. Yes.

Mr. SISK. I just want to state this was not Convair, but it was a southern California plant, I will say.

Mr. MITCHELL. Mr. Lanphier, do you think that the administration with its policy of defense, the overall policy is jeopardizing the national security?

Mr. LANPHIER. Yes, sir, I do.

Mr. MITCHELL. Do you think that President Eisenhower knows as much about defense as he says he does?

Mr. LANPHIER. No, sir, I do not.

Mr. MITCHELL. Would you amplify that statement?

Mr. LANPHIER. Well, he makes statements from time to time that disturb me and other professionals.

Mr. MITCHELL. Do you think he is ill advised in the field of national defense?

Mr. LANPHIER. I think sometimes he is not completely advised. For instance, he and some of his advisers have said several times that it isn't necessary that we match the Soviets in rocket thrust in the military area, that as long as we have enough to reach the target, it is sufficient.

He does acknowledge it is significant in space—extra thrust—but that here, of course, we are not in a race, according to him and therefore, there is not the extraordinary urgency to get this thrust any sooner.

I would argue with the statement that thrust isn't—the implication that thrust is relatively unimportant once you have enough to reach a target on the other side of the world on the military side. Thrust, in all weapons systems, is an absolutely important element. The more thrust you have, for instance, on a rocket like the Atlas, the bigger the warhead you can push over there. Therefore, the bigger the bang you have, therefore the less requirement for guidance. Or vice versa, from there to here.

Mr. MITCHELL. Do you believe there is a military application in space?

Mr. LANPHIER. Most certainly, sir. We, a number of companies have been for several years now thinking in these terms and until the Sputniks went up, getting very little reaction from the Government—the Pentagon was the only poker game in town in those days for ideas for space. Now there are two. As I say, several companies, including ours, have been thinking 10 to 15 years out in the future and the space program on the military side can be, if appropriately prosecuted—well, has to be, if we are going to maintain our relative standing with the Soviets, we are going to have to have first of all, satellites that warn us that their missiles are coming, then satellites that help destroy the missile—from which you can destroy the missiles. these things are feasible. We are going to have satellites that intercept each other, all because these people are putting pressure on us. I would like to see them matched in time and be out there before they are.

Mr. MITCHELL. It is your feeling that what we are doing today, what the administration is doing, constitutes a gamble with the lives of your five children?

Mr. LANPHIER. Yes, sir; I have said so and I believe it.

Mr. MITCHELL. You think the President is taking a gamble?

Mr. LANPHIER. Yes, sir; I think the President is taking an unwarranted risk.

Mr. MITCHELL. I must say, Mr. Lanphier, you have no ax to grind except that of trying to alert America to this danger and draw us out of this state of complacency; isn't that true?

Mr. LANPHIER. This happens to be my motive. I could be mistaken. I hope to God I am.

Mr. FULTON. Was or was not? I didn't hear that.

Mr. MITCHELL. I hope you are mistaken, but I am inclined to agree wholeheartedly with you that we cannot afford to risk what we are doing in defense at this time.

Mr. LANPHIER. May I make one other additional statement on the subject of the military——

Mr. MCCORMACK. Will the gentleman yield to me for an observation?

Mr. MITCHELL. Yes.

Mr. MCCORMACK. The question of whom Mr. Lanphier prefers nominated for President has been injected. I might say I suppose every American is going to pass on that question sometime.

Mr. LANPHIER. Yes, sir.

Mr. MCCORMACK. And our Republican friends are going to support Vice President Nixon after he is nominated. So if that is asked for the purpose of impugning motives, it applies all along the line, not only to every Member of Congress, but to every American throughout the country, because sooner or later, everyone who votes is going to pass upon that question.

The CHAIRMAN. The gentleman's time has expired.

Mr. MITCHELL. May I say I am for the distinguished majority leader for President.

Mr. LANPHIER. I would like to add I will also vote for him if he is nominated.

Mr. FULTON. May we just have a comment over here on that?

The CHAIRMAN. Mr. Wolf?

Mr. FULTON. Would you yield for a comment on that?

Mr. WOLF. If it is coming out of my time, I can't, I am awfully sorry.

The CHAIRMAN. Mr. Wolf is recognized.

Mr. WOLF. Thank you, Mr. Chairman. I am a Democrat, too, and I am very happy to state this.

I would like to state, sir, that I admire your courage.

Mr. LANPHIER. Thank you, sir.

Mr. WOLF. To come before this committee, of all committees, and all of this group of nonengineers, without a legal counsel and state flat-footed exactly where you stand is to be admired.

Mr. LANPHIER. Thank you. I hadn't thought of it like that. Thank you very much. I am trying to practice the democratic system and I believe I am being very graciously treated in this respect.

Mr. OSMERS. Is that a small "d" or a large "D"?

Mr. LANPHIER. A small one. The republican system of government, if you prefer, which is also democratic.

Mr. WOLF. I am not sure that the committee knows the great amount of courage that this man has or further knows exactly what is involved in the man that sits before us. According to this brochure that I have here, he was decorated with the Navy Cross, Silver Star with the oak leaf cluster, Distinguished Flying Cross with the oak leaf cluster, Air Medal, recipient of the Air Force Award for Exceptional Civilian Service in 1958. Aside from having five kids, it looks to me like you have done something for your country.

Mr. LANPHIER. Thank you.

Mr. WOLF. So I think your motives can be of the highest even if they don't agree with the status quo. You have two areas I was concerned in. You say this modern weaponry in the hands of the Soviet Union, can be assumed to have reached a qualitative and quantitative point at which our incalculable power to destroy an aggressor can now be itself destroyed, in the main, in a matter of moments.

Now this relates to the next part of the question. You say:

> Men of science and industry deserve better recognition than they generally get for the major role they play in maintaining the quality of the deterrent force in being. They also should be afforded readier access to such information as our intelligence sources may have developed regarding experience in similar technological fields on the other side of the Iron Curtain.

Mr. LANPHIER. Yes, sir.

Mr. WOLF. I wonder how you relate the two? The one says you have to assume without knowledge, apparently, and I am fascinated by this thing that the men who are trying to devise our weapons of war have no way of coordinating their activities with our secret service to know what the enemy actually has.

Mr. LANPHIER. Well, when I am making a public statement like this, unclassified, I try to make the statement in terms that will be popular—could be popularly understood and logically understood. This is why I was talking about assumptions.

In terms of intelligence it would be most useful for us to know whatever it is our Government has discovered about the successes and failures that the Soviets have been having in the same fields. It would

save us from running down blind alleys which cost us time and money.

Mr. Wolf. You mean even though you have been cleared——

I have held a top secret clearance with the Pentagon and a Q clearance with the Atomic Energy Commission—

you don't have access to all this material?

Mr. Lanphier. No, sir, this is a different subject of information. Intelligence information is in a different arena or is a different fraternity from the kind of information that top secret clearances allow you to have.

Mr. Wolf. I see. Yet you are supposed to design weapons to defend against the enemy even without knowing what the enemy has got?

Mr. Lanphier. That is right. We are told very little, the fact is we are told very little. What we do know we have to extrapolate pretty much. It is even difficult within our own country as between, say, the people doing business for the Army. There is no formal system, really accelerated formal system for us to convey to Redstone the mistakes we have made and so forth. There is, however, for the last 5 years an absolutely integrated informal arrangement between Von Braun's team on the one hand and Jim Dempsey, our guy who runs the Atlas program for us.

Mr. Wolf. God bless you and keep telling your story. I might not agree with what you are saying, but I will defend your right to say it.

(Aside)

Mr. Lanphier. I have got enough to last until about July, if my wife doesn't overdo it.

The Chairman. Mr. Karth?

Mr. Osmers. That is when they have the conventions?

Mr. Lanphier. That is right, coincidentally.

The Chairman. If you will come to order, will the gentlemen keep their minds on space?

Mr. Karth. If you can keep order from the kibitzers over there I am going to proceed.

The Chairman. The gentleman may proceed. We will try to maintain order.

Mr. Karth. I would like to join my colleague from Iowa in saying that I should not attempt to impugn your motives.

Mr. Lanphier. Thank you, sir.

Mr. Karth. There are many people of the opposite political persuasion who appeared before this committee this year.

Mr. Lanphier. I happen to be a Republican, myself.

Mr. Karth. I see. Opposite from my own. And I disagreed with them quite vigorously, with some of the statements they made. But I never impugn their motives. I felt sure they were giving us the honest conviction that they had on the subject matter that we are discussing and I should not impugn your motives either.

Mr. Lanphier. Thank you, sir.

Mr. Karth. I appreciate your being a great American.

You made several references in your prepared statement to SAC. Whether or not you have this information I don't know, but I should like to ask you if all of the money necessary were appropriated for full

time SAC airborne alert how long would it take SAC to make the necessary arrangements so that they could be fully airborne?

Mr. LANPHIER. Well, I do not propose and I don't think anyone——

Mr. KARTH. If this is security, don't divulge it.

Mr. LANPHIER. I say a significant number of SAC planes should be airborne. General Power has testified to this I know in the Congress this year, as to whatever number he thinks is significant. It is not all of SAC, it is less than half of this, that need be airborne at any time.

The CHAIRMAN. Will the gentleman suspend for just a moment. I have been told that the reporter is not able to get down all the words that are being said. The witness talks rather rapidly, and some of the members are interjecting statements, too. So if you will proceed just a little slower we would appreciate it.

Mr. LANPHIER. Thank you, sir. I believe it has been a matter of public testimony this winter, this last month, by General Power that it would cost something on the order of $800 million a year to do the maximum that he is talking about, beginning this year. I know that SAC has rehearsed this sort of thing last year, this is a matter of public knowledge, so I know that they are in a position to move into it fairly quickly with trained people who know how to do this. I could not say, and I don't think I should, how quickly they could do it if they were given a go ahead today.

Mr. KARTH. I have some information as to how long it would take to put an appreciable number of SAC planes into the air on an airborne, 24-hour airborne alert basis.

Mr. LANPHIER. I have an idea, too.

Mr. KARTH. And this is quite a considerable length of time. The only question that this leads me to is because we have gone so long before we have apparently made the decision to do anything about it, I merely ask whether or not you think this is a very late stage of the game to be deciding the question at the moment.

Mr. LANPHIER. Very. The period of time you are talking about is considerable, but it certainly doesn't extend through the next 3 years when this is going to be required and also it can be done on an incremental basis, I would suspect. I don't know this for sure.

Mr. KARTH. But it would be your opinion because of this so-called time lag which comes about?

Mr. LANPHIER. Yes.

Mr. KARTH. Before the decision is made and the act is finally completed?

Mr. LANPHIER. Yes, sir.

Mr. KARTH. The decision actually to put SAC on a 24-hour alert should have been made about a year ago or so.

Mr. LANPHIER. I think so. I think we are perfectly warranted in having them up there right now and the enemy knowing they are there. Certainly the possibility exists that they have enough to attack us even at this moment, the possibility exists. Under these circumstances with these completely final awful weapons we should not be underestimating the other guy.

Mr. KARTH. Mr. Chairman, I surely appreciate his comments, as a good Republican, here today. [Laughter.]

The CHAIRMAN. Mr. Hechler?

Mr. HECHLER. Mr. Lanphier, I would like to ask you about some of the remarks you made in response to questions by Mr. Miller on

the Polaris submarine. You say on page 3 that one of the things we lack is a defense against submarine attack.

Now, I gather you think that submarine defense is more important than the development of Polaris itself as an offensive weapon?

Mr. LANPHIER. No, sir. They have a different mission, of course. I think there is—the problem of attack against this country from submarine-launched missiles, either surfaced or from under the sea eventually à la Polaris, is equal to the problem of missile attack. But far, far, far less is done about it than is done about the missile attack, because we are building retaliatory missiles to counteract the missiles in that respect, but they are equally important.

Mr. HECHLER. What I am trying to assess is where you would place Polaris in the perspective of what you think this country needs in the future?

Mr. LANPHIER. My problem, apparently, is that I can't see why we should have priorities for five or six things each of which is absolutely essential. So I think we ought to do them all concurrently. That is my problem; that is why I can't give it a priority.

Mr. HECHLER. In answer to questions by the chairman, you feel then that really many of these things would fall into place if we had what you call a reorientation of national attitude? This is really the core of the whole problem?

Mr. LANPHIER. Yes, sir. If the threat were clearly understood and clearly outlined, they would fall in place—that is, things would balance against them. As they come over here before your committees they would have to justify what they were asking for in relation to a known threat, everything would fall in line, it makes it much simpler.

Mr. HECHLER. I would just like to observe that I am always very, very proud to see my Republican colleagues rise to the defense of what is today America's greatest minority group. That is all.

The CHAIRMAN. Southerners?

Mr. FULTON. Who do you mean?

Mr. HECHLER. The Republican Party.

Mr. CHAIRMAN. Mr. Daddario?

Mr. DADDARIO. Mr. Lanphier, taking into consideration the many lacks that you have referred to on page 3 and your experience in industry, is it your opinion that the United States has the industrial capacity or has not the industrial capacity to accomplish these ends if properly harnessed?

Mr. LANPHIER. Yes, sir; most certainly. I don't know that we can do it in time. But I certainly think we have the capability. It remains to be seen whether we have the time. We have the people to apply to these things, yes, talented people.

Mr. DADDARIO. Well, you have referred to the fact that American men of science and industry deserve better recognition. What do you mean by that? In what way would better recognition, in whatever form you decide it should be given, in what way will it help to close these gaps to which you refer?

Mr. LANPHIER. Well, as I have remarked before, we are in the only phase of the third world war that we have a chance of winning: the deterrent phase. Our chance of winning that—and we may have already lost it, I don't know—we may lose it next year or we may never know we have won it; it may go on for decades. In any case

our chances of continuing to win it, if we are still winning it, are a combination of the quality and quantity of the force in being at any given moment with which to deter Khrushchev or whoever succeeds him, that one man, that group.

The quality of the force in being is primarily engineered and has been for the last 10 to 15 years from science and industry, not the other way around [from Government]. Time was when the military said, "This is our problem of tomorrow, I want a thing that will go this fast, this far," and so forth. They still do this in some respects. But more and more things like the Atlas, B–58, and so forth, are engineered out of a process of product analysis, if you will, of what the enemy is going to be doing 5 and 6 years from now in terms of the threat, an assessment of what appropriate system might meet that threat at that time. Then a competition with the rest of the industry to see if you can win with your own idea and away you go. This is my point. The people in industry and in science are on the front line of the combat in World War III and not too many people quite appreciate it, and I include here the Congress. Last summer Congressman Hébert had a hearing that lasted for several weeks in which this point was never clearly asserted by anybody from the industry. I don't think they bespoke themselves very well.

Mr. DADDARIO. Your point is that better recognition would not necessarily close the gaps but it would be deserving of these people for their advance planning and for the awareness that they show to the responsibilities that industry has to the preservation of this country from the standpoint of weapons system developments?

Mr. LANPHIER. Yes, sir. It would expedite their mission, too.

Mr. DADDARIO. Now, my colleague, Mr. Wolf, has touched on this business of intelligence information being passed back and forth. Do you believe corollary to that that American industry has properly taken advantage of the large number of technical pamphlets in our country?

Mr. LANPHIER. No, sir.

Mr. DADDARIO. And technical information which is published and which is readily available to all of us?

Mr. LANPHIER. No, we do not; I grant you that we do not.

Mr. DADDARIO. What do you think industry could do to take better advantage?

Mr. LANPHIER. We each have our problem. In Convair we have some 65,000 people. We try—one of my jobs is to try to coordinate and keep up to date such information as this, to keep the people in each of the divisions and programs—to force feed them, because it is a job each company has to do as best it can. To the extent it does it well it progresses beyond some of the others.

Mr. DADDARIO. Is it possible that a centralized agency which could feed to industry that information which each of the industries happen to be working on might be the answer to the utilization of that, because it is information which is here before us, which has nothing to do with intelligence but just properly utilize information on hand?

Mr. LANPHIER. The problem there is who knows what who needs. In my company I would have had to know everything you had available to determine whether I can use any part of it. I despair of the

bureaucratic approach to it if it is done by the Government. Time is the problem.

Mr. DADDARIO. It is one of the problems.

Mr. LANPHIER. Yes, sir; communication is a problem in our outfit like——

The CHAIRMAN. The gentleman's time is up.

Mr. Moeller?

Mr. MOELLER. Mr. Lanphier, I wasn't here at the beginning of the session. I am disturbed about something I read in the last full paragraph of your testimony where the statement is made, "I am regretfully leaving the country"—that should have been "company?"

Mr. LANPHIER. I said "company." I was dictating with toast in my mouth.

Mr. MOELLER. I am probing not so much into what you are saying but why you are testifying as you do. You say we ought to be spending between $4 and $5 billion a year?

Mr. LANPHIER. That is my best guess.

Mr. MOELLER. Where would you say we ought to spend it? Have you told us?

Mr. LANPHIER. Yes. I would be glad to run through it again. You were absent.

Mr. MOELLER. All right.

Mr. LANPHIER. I would suggest a general thing be done. That is, an effort by the President to make a more candid statement of what the threat is and what must be done to meet it. Thus to reorient the national attitude to adapt itself to hurrying up to get some of the things done that must be done in the next 2 or 3 years or almost immediately. On an immediate—I would convert to a method of developing the budget from year to year by directly relating it to the threat. A threat that is understood in the summer of each year by both Congress and executive branch, then both sides working toward a budget in January that they understand has a real bearing on the problem with which we live.

In terms of immediate action I would get a significant element of SAC in the air, whatever that cost. I would buy more tankers, the KC–135's, because we already need them for SAC, we are going to need them for airborne alert.

I would accelerate both the Atlas and Titan programs. I know the Atlas can be accelerated into more hardened bases by the end of 1962. It is not currently planned to do so. It peters out at the end of 1962. I believe the Titan can also be accelerated. An effort should certainly be made to get more of both of these missiles out there and in ground within the next 2, 2½ years.

Meanwhile, rush the Polaris and the Minuteman, mobile systems, which make better retaliatory systems than the Atlas and Titan. My concern, expressed earlier, is we are not going to get them anywhere near as soon as many people say we are. We keep kidding ourselves this way as an excuse for not having some more in force today. We can't afford to continue to do this.

I would suggest an acceleration of the Midas and Samos, these two surveillance weapons space systems that the Air Force has underway to take a look at what the enemy is doing and warn us if he fires missiles at us.

I suggest more B–52's and B–58's for use 2 or 3 years hence when the airborne alert wears out the present force.

I would, by all means, suggest the immediate procurement of airlift and considerable airlift for the Army and Marines to begin to lend some mobility to such limited war deterrent as we currently have, a mobility which we don't have. Witness General Taylor's excellent book on the subject, "The Uncertain Trumpet."

And I would urge a civil defense program.

Mr. MOELLER. You have covered it.

Mr. LANPHIER. Yes; by all means.

Mr. MOELLER. Did I read correctly in the newspapers you gave up a $50,000 job because of your disturbance over this present situation? You have no other income?

Mr. LANPHIER. No, sir.

Mr. MOELLER. Have you been approached by anyone else for a position?

Mr. LANPHIER. Yes, sir.

Mr. MOELLER. In a similar type work?

Mr. LANPHIER. No; I am not going to go back into the defense business.

Mr. MOELLER. All right. May I ask you if you are aware of other men who were at one time in a similar position as you who may now be entertaining the idea of doing the same thing in order they might protest?

Mr. LANPHIER. I have had some interesting mail since I made my little dive off the high board.

Mr. MOELLER. In other words, we know you are not a lone wolf in this crusade.

Mr. LANPHIER. No, sir.

Mr. MOELLER. You feel this number might be growing?

Mr. LANPHIER. My experience is only limited to 2 weeks. In this couple of weeks I would say really valuable people in the defense effort who should stay there, I would say a dozen, probably, indicated in the next 2 or 3 months if something specifically isn't done they might publicly protest.

Mr. MOELLER. The sole reason for these people sacrificing lucrative jobs is because they are convinced that our defense posture is not what it ought to be today.

Mr. LANPHIER. Yes, sir. I can say this absolutely, that the great majority of scientists and engineers whom I know—and I have known a good number of them over the last 10 or 15 years and we have some of the outstanding ones in the country working at Convair—the majority agree with what I have said, some of them can say it far better, but nobody with more vehemence or conviction. It is not fair to quote somebody blindly, but that is a fact. It also goes for some people in uniform. Unfortunately, when they do say it people think they are grinding an ax. Unhappily. There is a general assumption that a guy has some angle, he is trying to sell missiles or sell his service, and it could be so. The unhappy fact is that the very people who are authoritative in the field are these people in the industry and in the service. If they are discredited as authorities whenever they say anything on the subject of the national emergency

I don't know where we would look for an exercise of the democratic system, especially on a critical subject like this. So I got out.

Mr. MOELLER. And you are absolutely convinced that these men are not motivated for any political reasons whatsoever?

Mr. LANPHIER. No, sir; not any more than I am.

Mr. MOELLER. That is all.

Mr. FULTON. Even with a presidential year coming up?

The CHAIRMAN. Mr. King?

Mr. LANPHIER. You have your point of view, Mr. Fulton, more power to you.

Mr. KING. Just one brief question.

Time and again we have had officers from the Defense Department and elsewhere come before us and the same question has been asked invariably; namely—Do you need more money? If the appropriation were increased could you use it profitably and usually the answer was something to the effect that, "No, no; we couldn't use much more if any; it isn't as simple as just turning a valve; after all research and development takes time and you can't force these things; we are moving just about as fast as we can move and if we had more money it would just have to lie idle until certain basic research and other things had been accomplished." So I should like to ask you in a general way inasmuch as you just got through saying that we should accelerate our Titan and Atlas and Minuteman program and so on, do you think that we could put on the steam, perhaps appropriate more and use it profitably right now?

Mr. LANPHIER. Yes, sir, you can always say at a given moment that there are some things you can't do in the next 6 months with money, that is true, and especially with these complicated systems as they are now. However, the fact is also that at any given moment you can start to doing something about 6 months hence. If you wait, in another 6 months you can again at that time say that, "I can't spend any money in the next 6 months." This has been going on in Mr. Truman's time, Mr. Eisenhower's time and I would like to hope it would pretty soon quit in terms of at least the defense effort.

Mr. OSMERS. Would the gentleman yield for one question?

Mr. KING. Yes, sir.

Mr. OSMERS. Mr. Karth before asked the witness a question with respect to the access which the witness has and has had to intelligence estimates of our potential enemies and as I understood the reply you said that your top-secret clearance did not give you access to enemy intelligence estimates.

Mr. LANPHIER. No.

Mr. OSMERS. If that is so, how are you then able to make positive testimony without knowing the intelligence estimates of our potential enemies?

Mr. LANPHIER. Well, I will revert to the colloquy with Mr. McCormack. I made assumptions that anybody can make who is in this business. No. 1, that had we done 2½ years ago what the Soviets did 2½ years ago we could by now have 400 missiles in this country. Reversing that, you can assume the Soviets have done the same since they have declared over and over again that this is their intention.

No. 2. In 20 years, 4 of which I took out for the newspaper business, the other 16 of which I have spent in this defense effort one way

or another, in 20 years you get to know a great number of people. In all aspects of the defense effort, including the intelligence fraternity and people are people and some close friends are close friends and clearances are clearances. All I am saying is that I am trying to keep my argument clear out of the intelligence field and I make no claim to having any formal knowledge of what the Government understands the enemy to have, although I wish the Government would acquaint some of us in the business of supporting the defense effort a little more readily than they do.

Mr. OSMERS. In other words, your remarks here are made without any knowledge of what the intelligence information is about the enemy?

Mr. LANPHIER. If that is what I just said, that is what I just——

Mr. OSMERS. All right.

Mr. KING. Mr. Lanphier, reverting to my question, what you in effect are saying is that if the well only holds so much water, instead of year after year after year just saying that it holds so much water——

Mr. LANPHIER. You can start building the well bigger.

Mr. KING. Enlarge the well, immediately.

Mr. LANPHIER. Yes, sir, 6 months in some things, a year in others, none in some.

Mr. KING. Thank you.

The CHAIRMAN. Mr. Roush?

Mr. ROUSH. Mr. Lanphier, specifically what was your job with Convair?

Mr. LANPHIER. For most of the time I have been there I have been in charge of the long-range planning, product planning for the company.

Mr. ROUSH. How close is that to the top?

Mr. LANPHIER. I was the—I guess the No. 2 or 3 man in the company.

Mr. ROUSH. All right.

Now, your statement here is a very sharp and critical statement of not only our present defense posture, but what will be our defense posture over the next few years. It is very critical and it is very forthright.

Apparently you are of the opinion and conviction that somewhere along the line certain wrong decisions were made.

Mr. LANPHIER. Or not made at all.

Mr. ROUSH. Or not made at all.

Would you care to list some of these wrong decisions or decisions which were not made which would have put us in a better position today?

Mr. LANPHIER. Yes, sir. I will just go back 1 year or about 15 months.

When there were some of us carrying forward the argument that there ought to be at that time ordered more Atlas missiles to be hardened and dispersed, it took us almost 6 months to get agreement to disperse and harden them, which in turn requires the enemy to have that many more to destroy them. We never could get agreement that there should be more than the Atlases that were ordered last winter. However, the Congress last spring ordered 8

more squadrons or funded 8 more squadrons. This winter the President accepted the money for 4 of them and is buying them, but not the other 4.

My simple point is I wish he had decided that last year, accepted them last year and accepted all 8 of them, we would be that much better off next year than we are going to be, which is pitiful.

Mr. Roush. Can you point to any other decisions which were not made or wrong decisions?

Mr. Lanphier. I have yet to see a decision made as to what we are going to do in terms of both the physical support of and the establishment of a policy, for instance, over Berlin. I don't like to be in a position where I sat last spring and heard the President tell me, when they asked him if he was going to meet the East German movement on the ground, and he said: "Anybody knows we don't have the force to meet them on the ground." They said: "Will you use the big bombs?" He said, "We will face that when we come to it," or something of the sort. To me what he was saying was that he will decide at that time whether or not my country is going to commit suicide over Berlin. Obviously if we use the big bombs it is going to be a mutual exchange which will destroy us both. It is also not too obvious to me that any President might even do that. Therefore, I don't like to have my country in a position where it doesn't have an alternative, the alternative being something that the enemy respects on a localized basis. I see no currently planned alternative, except to drift along to Paris this spring, and we are going to lose a bit of ground as we did last winter.

Mr. Roush. Would you say the decision to cut the Atlas thrust down to 360,000 pounds which I believe was made in early 1953, or 1954, was that a correct decision?

Mr. Lanphier. That was a technical decision made because at that time we learned the bomb was to be smaller. We then found out a year after it was known in other elements of the Government that a smaller bomb was available. We worked for 1 year on an Atlas that was not necessary; that is, a five-engined one. When we were notified officially a year later than it was known in other parts of the Government that a smaller bomb was available then we reduced the power because it was what was required to get the job done, and it increased the reliability of the system.

Mr. Roush. During your testimony you said the advanced Atlas missile was pending a decision in the Pentagon. By chance, that doesn't refer to the Atlas something like the original Atlas 600,000 pounds?

Mr. Lanphier. No; this actually has the same number of engines, uprated engines.

Mr. Roush. What thrust?

Mr. Lanphier. I am sorry; I don't recall. I can get that for you. [The exact figure is not yet unclassified.]

Mr. Roush. Will it have a greater thrust?

Mr. Lanphier. Yes; considerably. It will do what the second Sputnik did.

Mr. Roush. Will it be similar to our F–1 engine or what our F–1 will be capable of, or Saturn project?

Mr. LANPHIER. No; not that strong. It is between—between the current Atlas and the Centaur combination. This is not a double-stage operation; this is just an uprated Atlas engine, bigger in power.

Mr. OSMERS. Will the gentleman yield?

Mr. ROUSH. No; I am sorry. I decline to yield.

Do you believe we have a present military requirement for a large thrust engine?

Mr. LANPHIER. Yes. There will be a requirement when we can get to the point in history when we have such an engine; yes. Not in terms of carrying a payload to some other point on Earth if that is what you mean, but certainly in terms of carrying a payload out into space.

Mr. ROUSH. Now, I am referring to our present needs.

Mr. LANPHIER. I don't believe——

Mr. ROUSH. You are projecting it into the future?

Mr. LANPHIER. Yes. I don't really believe that except for the advancing a little earlier bigger packages in space that either the Atlas or the Titan ought to be uprated if either one of them is bought but if either should be bought I would obviously prefer to see the Atlas for a number of technical reasons and the calendar advantage it offers.

The CHAIRMAN. The gentleman's time has expired.

Mr. Morris?

Mr. MORRIS. Mr. Chairman, Mr. Lanphier, what do you think of the Bomarc B versus the F–108 interceptor?

Mr. LANPHIER. I don't think either one of them makes much sense.

Mr. MORRIS. Well——

Mr. LANPHIER. I don't mean to be flip. I just don't. The defensive systems that we are groping with now, the Bomarc, the Nike-Zeus and the proposed F–108 don't warrant the kind of moneys that are being put into them in terms of the return you get as an added element to the deterrent, no one of the three that you have mentioned, sir, I don't believe.

Mr. MORRIS. Now, you are in favor of an antisubmarine defense development?

Mr. LANPHIER. Yes, sir.

Mr. MORRIS. I agree with you 100 percent. Yet you are not in favor of the proposed development of an antimissile?

Mr. LANPHIER. I didn't say that, sir. I just talked about that specific one.

Mr. MORRIS. You talked about the Nike-Zeus.

Mr. LANPHIER. That is what I said. I don't think—that is what I meant earlier—that specific approach is technically valid to the problem it is trying to resolve. I would certainly like to see the continued prosecution of an antiballistic missile system. It is a feasible thing in 6 to 7 years, though by that time the other guy is going to have a new trick.

Mr. MORRIS. But the Bomarc B missile you think should be canceled right now?

Mr. LANPHIER. Yes, sir, I don't see much sense in it.

Mr. MORRIS. But F–108 fighter, you don't think——

Mr. LANPHIER. I don't think the mission it could accomplish if it were brought in 5 or 6 years hence, which is when it would be available, would be worth the money it is going to cost. No, sir, when

you evaluate it against what other things cost and balance what you have to buy in retaliatory systems.

Mr. Morris. Why I am asking you these questions, these are some of the things that could be done within the framework of the organization at the present time?

Mr. Lanphier. Yes, sir.

Mr. Morris. You recommended certain long-range and certain changes to be made in the whole system within your list, the six things that you recommended, such as the President making available what the missions are and assigning them, and they should be justified on the basis of the threat.

Mr. Lanphier. Of the threat; yes.

Mr. Morris. Now, you say that you think more money should be spent on the Minuteman and the Polaris?

Mr. Lanphier. Yes, sir, to accelerate them—to accelerate.

Mr. Morris. I definitely agree with you there. But you also state on the Titan—let's talk about the Titan versus the Atlas. Are not the Titan and the Atlas almost the same missile?

Mr. Lanphier. They are exactly.

Mr. Morris. Why go spend more money on the Titan then when we have an operational Atlas which can hit the target within 2 miles in a 7,000-mile shot?

Mr. Lanphier. Because hopefully the Titan will do the same when it reaches its operational state and we need the numbers at that time.

Mr. Morris. Why not produce numbers of Atlases?

Mr. Lanphier. I would like to see more of each.

Mr. Morris. You have a proven system?

Mr. Lanphier. But in the next 2 years there are just so many more Atlases that you can buy hardened. So what I am saying is buy more Atlas and buy more Titan in the same period.

Mr. Morris. Do you mean to tell me the Defense Department can't cancel the money for the Titan since the Atlas can do the job?

Mr. Lanphier. I would rather see the job go ahead with both of them. I would like to see the numbers from whatever source as soon as possible. In 3 years from now we could afford through just the Atlas program alone all the missiles in the third year the country thinks it might need.

Mr. Morris. But the part about your testimony that I don't understand is that you are in favor of greater numbers?

Mr. Lanphier. As soon as possible.

Mr. Morris. I agree with you there. Well, why gamble on a machine that isn't proven when you have one that is proven that will do the same job.

Mr. Lanphier. Why not go ahead with that one—then you are not gambling—and gamble on the other one, too.

Mr. Morris. Why not improve the one you have. Whenever you get an automobile, from the time that an automobile is invented up to the present time, an automobile is still an automobile, it has wheels, brakes, and motor.

Mr. Lanphier. I refer to my basic concern, that is, over the next 2 to 2½ years somewhere we are going to have to have greater numbers than we have planned. You can't get——

Mr. Morris. Can you mass-produce Atlas and Titans quicker than you can mass-produce Atlas missiles alone?

Mr. LANPHIER. No, sir, I didn't say that—oh, yes, you can get double—you can get some Atlases between now and 1962 regardless of what you do about the Titan.

The CHAIRMAN. The gentlemen of the committee cannot hear. Members of the committee cannot hear; there is so much noise going on.

Mr. MORRIS. The part that I can't understand is that you don't know—we are speaking within the framework of the organization and the budget that we have now and what looks like might be a recommendation for the future and you are recommending that we spend part of this money on a gamble on the Titan, which has not been proven.

Mr. LANPHIER. Most of the gamble on the Titan has been taken in terms of dollar investment. I would say a couple of billion dollars' worth of investment has been taken. We might as well realize on it.

Mr. MORRIS. Probably going to be another billion before it is proven.

Mr. LANPHIER. Well, it should be; that was the case of the Atlas to get to this operational point.

Mr. MORRIS. But the point is, it seems to me, it would make more sense to take this billion dollars——

Mr. LANPHIER. Why not buy a billion dollars' worth of each?

Mr. MORRIS. You don't know the Titan——

Mr. LANPHIER. My point is we can build you just so many Atlases by the end of 1962; that takes X dollars. I forget the dollars, but it is about 45 more Atlases in hardened bases if they wanted to buy them. That is all we can do in our plant in 2 years and support with bases.

Mr. MORRIS. If these people who are trying to build the Titan—couldn't they build some Atlases?

Mr. LANPHIER. No, sir; not in the next 2 years, that is my point.

The CHAIRMAN. The gentleman's time has expired. Mr. McDonough?

Mr. OSMERS. Would you yield to me for a couple of brief questions?

The CHAIRMAN. For a brief—for a question.

Mr. MCDONOUGH. All right; I yield.

Mr. OSMERS. I was very much interested, Mr. Chairman, in the witness' observations on global strategy in Europe, his observations about Berlin. Is it fair to draw the inference from what you said, Mr. Lanphier, that you believe this country should attempt to establish superior ground and conventional forces in Europe to those of the Communist bloc?

Mr. LANPHIER. One way or another, yes, sir; not in terms of matching them man for man, but in terms of more imaginative devices than that. We at Convair have had for about a year and a half a committee of five fairly well-versed gentlemen consisting of Dr. Edward Teller, Dr. Kissinger, Dr. Morgenstern, Dr. Wheeler, and Dr. Sherwin, all five of whom have worked as consultants for the Secretary of Defense and the Air Force and so on over the past few years. They have been working on a project to consider the problem of limited war in all its aspects, economic, political, and military. They have come up with some interesting possibilities of mechanical devices and systems that can substitute, if prosecuted, for numbers of people on the ground.

I would like to see the Government doing something like this.

Mr. OSMERS. The Government hasn't done anything like that at all——

Mr. ROUSH. Point of order. The question has been answered.

Mr. OSMERS. This muzzled program, it is rather interesting.

Mr. MILLER. It is not muffled.

The CHAIRMAN. The gentleman is wrong about a muzzled program. This is a rule adopted by the committee and we are trying to enforce it.

Mr. MCDONOUGH. You were assisting Mr. Symington in the Defense Department, weren't you?

Mr. LANPHIER. Yes, sir; about 11 or 10 years ago.

Mr. MCDONOUGH. During that time the defense potential was a problem for the Nation as it is today?

Mr. LANPHIER. At that time the limit the country could stand, I think, was $13 or $14 billion, until Korea and it jumped to $60 billion.

Mr. MCDONOUGH. Why wasn't there at that time, since you are apparently so ambitious at this time to close the gap between Russia and the United States, why at that time weren't you instituting an ICBM program, a rocket program, something beyond the B–36 and the other——

Mr. LANPHIER. The Air Force was, the Air Force was doing the Navaho program.

Mr. MCDONOUGH. How far did they go with it?

Mr. LANPHIER. Right up to the point where it is now propelling all the ICBM's we have.

Mr. MCDONOUGH. The Navaho is certainly not an ICBM and it became obsolete before it became operative.

Mr. LANPHIER. The engines did not, they were the ones that power the Atlas and Thor.

Mr. MCDONOUGH. The criticism has been leveled——

Mr. LANPHIER. I am not talking about the past. I am talking about today and tomorrow.

Mr. MCDONOUGH. I am talking about today, too. The situation today is one that is a matter of numbers. We haven't had our defense tested, we haven't had any challenge. All we are talking about is a possibility——

Mr. LANPHIER. I see challenges every 3 or 4 months, in space, clearly written, clearer than any adversary has ever done before.

Mr. MCDONOUGH. Such as what? You mean scientific challenges?

Mr. LANPHIER. Of course, related to military.

Mr. MCDONOUGH. We haven't established that yet.

Mr. LANPHIER. We have to disagree, in our business.

Mr. MCDONOUGH. It hasn't been established to the point that a satellite has a defense potential, it has a communication or reconnaissance or a potential of that sort.

Mr. LANPHIER. I beg to differ with you, sir. That is why I am here.

Mr. FULTON. Would you yield?

Mr. MCDONOUGH. Yes.

Mr. FULTON. The question comes on your use of Air Force bases, published by the Military Service Publishing Co. of Harrisburg, my home State, as a basis for your estimates. Then they say:

The publisher will welcome suggestions and criticism which will, in any way, provide a basis for improvement of the book. Where any installation has been omitted, due to inadvertence or through lack of information, we will be most grateful for data concerning it.

My question is this. You rely on that. But the President of the United States appeared before Congress on March 13, 1959, and gave us what the bases were. My question is have you studied that particular message because there the President says:

Our friends among the free world nations make available to us for the use of our forces some 250 bases in the most strategic locations, many of them of vital importance. They support ground forces totaling more than ——— million men stationed at points where danger of local aggression is most acute, based on their own soil, and prepared to defend their own homes. They man air forces of about 30,000 aircraft of which nearly 14,000 are jets, 23 times the jet strength of 1950 when the program started. They also have naval forces totaling 2,500 combat vessels with some 1,700 in active fleets or their supporting activities.

He likewise says they have spent $141 billion, our friends have, more than six times the $22 billion we have contributed in military assistance. During calendar year 1958 they contributed $19 billion of their own funds to support these forces.

First, have you studied this message of the President or read it?

And in that conjunction, of course, I would like you then to show that you have by naming the number of million troops that our allies have supplied in the one place that I left it vacant. That will show very conclusively how much you have studied it. So you name them.

Mr. LANPHIER. I obviously don't know the number.

Mr. FULTON. And you obviously haven't studied it, have you?

Mr. LANPHIER. That is right. That is not pertinent to what I am talking about.

Mr. FULTON. I would imagine——

Mr. LANPHIER. If I may do some simple mathematics, I assume you are trying to get this straight from me, are you not, as to whether or not there are less than 100 bases and whether or not I am sure there are less than 100 bases from which SAC and our other forces can retaliate? Is that what you are groping for? Is that what you want to know from me?

Mr. FULTON. I don't believe I would like to have put into my mouth——

Mr. LANPHIER. You have been doing that for me all day.

Mr. FULTON. I asked some telling questions——

Mr. LANPHIER. I am trying to give you an answer——

The CHAIRMAN. The gentleman's time has expired.

Mr. FULTON. The figure is 5 million men the others have supplied.

Mr. MILLER. How many of those in Korea?

The CHAIRMAN. Your time has expired.

Mr. MCDONOUGH. My time has expired?

The CHAIRMAN. Yes.

Mr. MCDONOUGH. I thought we have 5 minutes.

The CHAIRMAN. You do. Your time expired 2 minutes ago.

Now, gentlemen, we have 2 minutes before we adjourn. We are due promptly on the floor. I talked to Mr. McCormack about this bill and he said that the bill is coming up right after convening.

Mr. FULTON. Second time around, I wanted 5 minutes, I didn't take it all.

The CHAIRMAN. So have I. I will say to the gentleman, as chairman, that I cut my 5 minutes a little short so as to help the gentleman.

Mr. LANPHIER. The burden of what I am talking about, that there are less than 100 points that the Soviets have to aim at to get our whole retaliatory strike force, is contained in General Power's statement, if you assume 300 missiles will do the trick.

Mr. MCDONOUGH. Presuming every one of them is going to hit the target and all shot at the same time.

Mr. LANPHIER. No, you are assuming three of them, of which one will hit the target.

Mr. MILLER. I move we adjourn.

The CHAIRMAN. You heard the motion.

Mr. FULTON. I object to adjourning.

Mr. MILLER. It is not debatable.

Mr. ROUSH. Point of order.

The CHAIRMAN. The motion to adjourn is not debatable. All in favor of the adjournment——

Mr. FULTON. I object to the adjournment when we have further time that we can use this morning.

The CHAIRMAN. All in favor of adjourning at this time, signify by saying "aye." All opposed?

The ayes seem to have it. The ayes have it. We will adjourn until tomorrow morning at 10 o'clock.

(Whereupon, at 11:51 a.m., the committee adjourned to reconvene at 10 a.m., Tuesday, March 8, 1960, on another subject.)

ADDENDUM

In the original planning of the hearings on the review of the space program, as approved by the chairman of the committee, it was intended to hear from six representative major contractors in the space business, with a due regard for previous coverage of companies in other separate investigations of the committee since its formation early in 1959. Invitations were extended to the Boeing Airplane Co., Convair (a division of the General Dynamics Corp.), Douglas Aircraft Co., Lockheed Aircraft Corp., the Martin Co., and North American Aviation, Inc. This number was the maximum which could be scheduled with adequate time to go into their presentations with any thoroughness, considering other obligations of the committee. As the time approached for these hearings on February 25, 26, and 29, it became apparent that it would not be possible to hold to the approved schedule, and the chairman directed that the witnesses be asked to stand by for later rescheduling, possibly in April. When it was apparent that this was out of the question, too, because of the heavy legislative workload of the committee, it was the chairman's hope to salvage for the record any material already prepared by the companies concerned, by its inclusion in the record of the space program review hearings. A cutoff date of May 10 was chosen. The basic correspondence and reports submitted in response to the request are as follows:

The letter of invitation addressed individually to the six companies is as follows, omitting only the names and information on date and hour of appearance. (These letters were dated in the period January 21–25, 1960):

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C., January —, 1960.

Mr. ——— ———, *President.*

DEAR MR. ———: This letter is to confirm oral arrangements for the appearance of * * * before this committee on February —. Your witnesses are asked to testify as the * * * group on that day. * * * Approximately 2 hours will be required for hearing the statement, questions, and any supplementary discussion.

Your Washington representative can receive guidance as to the committee's principal interests as the hearings unfold, as your appearance will be near the end of 6 weeks of hearings. I have already sketched orally some of these needs, and will be glad to amplify to him. In general, this committee is doing three things in these hearings: (1) studying the status of our space and missle programs with a view to determining what needs to be done to enhance their success; (2) reviewing the NASA budget request for 1961 which it must authorize; and (3) considering at least in preliminary fashion the President's proposals for amendment of the Space Act of 1958, and transfer of the ABMA facilities to NASA.

Only 3 days have been made available for hearing industry witnesses, and your company is one of six major participants in the space and missile programs which have been selected to be heard in support of the committee objectives outlined above. From your company, we should like to have a statement on your capabilities to support the national space and missile effort, in-

cluding both projects currently underway and as time permits developments which you see in the offing. We should also like any reactions to problems beyond your individual company as to the organization and funding of our space effort.

The committee would like to have a formal statement. This can be read or summarized orally so as to take approximately 10 or at the most 15 minutes of the time available, with any longer account if required printed in the record. The chairman would like an unclassified statement which can be presented in open hearing. Out of the approximately 2 hours available, perhaps 1½ should be reserved for open session, and the balance for any classified briefing, or for answers to earlier questions which can not be given in open session.

Under the rules of the House of Representatives, statements should be delivered to the clerk of the committee, room 214–B, New House Office Building, at least 24 hours in advance of the hearings. It would be wise to print at the top of the statements "Hold for Release Upon Delivery," and indicate the intended date of testimony. Approximately 150 copies are required to meet the needs of the committee and the press and radio galleries of the Capitol.

As soon as you have selected any corporate management and technical witnesses who will support your appearance before the committee, we should like to have their full names and titles, and a brief biographic note on each which will later be printed in the record. If your appearance involves charts, slides, or motion pictures, your Washington representative should make the necessary arrangements to insure proper logistic support.

The date confirmed in this letter is as definite as is possible under the circumstances. We expect to be on schedule, but in all fairness, experience has shown rescheduling does occur, and if this happens, we shall send as timely notice as possible.

We look forward to having you with us, and expect a very profitable session.

Sincerely yours,

CHARLES S. SHELDON II,
Technical Director.

Written acknowledgements were received from the following (the others being oral):

LOCKHEED AIRCRAFT CORP.,
Burbank, Calif., February 3, 1960.

DR. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR DR. SHELDON: I acknowledge receipt of your letter of January 21, which arrived during my absence on a business trip to the East. I can tell you that, with respect to the appearance of the Lockheed Aircraft Corp. before your committee at 10 a.m. on February 29, our company will be represented by Mr. Robert E. Gross, chairman and chief executive officer, and Mr. L. Eugene Root, group vice president in charge of missiles and electronics. By virtue of the nature of his responsibilities, Mr. Root is the one we regard best qualified from a technical standpoint to comment on the science and astronautics aspects of our activities.

Enclosed herewith you will find a short biographical note regarding both of the individuals concerned.

We will be guided in our preparation by the information contained in your letter. In case you have further information for us, you may find it convenient to send it to us through the medium of our Washington office, and specifically Mr. Hal Conner, who concerns himself for us with such matters.

We appreciate the opportunity to appear before your committee and thank you for the consideration which has prompted you to invite us.

Sincerely,

COURTLANDT S. GROSS, *President.*

BOEING AIRPLANE CO.,
Seattle, Wash., February 3, 1960.

Dr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR DR. SHELDON: Receipt of your letter of January 21, requesting the appearance of the Boeing Airplane Co. on February 26, 1960, to testify before the House Science and Astronautics Committee, is acknowledged. We have decided to have either Mr. Wellwood E. Beall or Mr. Edward C. Wells appear before the committee as a representative of corporate management, and to have Mr. Robert H. Jewett, Mr. George C. Martin, or Mr. Lysle A. Wood appear as technical spokesman. Brief biographical sketches on these gentlemen are attached hereto for the record.

We shall prepare Boeing's presentation generally in accordance with the guidance contained in your letter. We also will be guided by our Washington representative, who, as you suggested, has been asked to follow the hearings so as to gain the best possible understanding as to the committee's interests. Requirements for logistic support for this presentation will be coordinated through our Washingon office.

We are hopeful that the testimony of Boeing Airplane Co. officials on February 26 will be of value to the committee.

Sincerely,

WILLIAM M. ALLEN, *President.*

DOUGLAS AIRCRAFT CO.,
OFFICE OF THE PRESIDENT,
February 12, 1960.

Mr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR MR. SHELDON: This responds to your letter of January 25 and confirms that Douglas Aircraft Co. witnesses will appear before the House Committee on Science and Astronautics on February 29.

We have selected to represent us three men we consider highly qualified to provide the committee with the material it desires. They are Mr. Charles R. Able, vice president—defense programs; Mr. R. L. Johnson, chief engineer—missiles and space systems; and Mr. Maxwell W. Hunter, assistant chief engineer—space systems. Biographical material on these gentlemen is enclosed herewith.

Mr. Able will deliver a formal statement, copies of which will be forwarded in advance as requested. Any additional details regarding our appearance before the committee may be coordinated with our Washington representative, Mr. L. E. Tollefson.

I am conscious of the importance of the committee's work, and trust we shall make a worthwhile contribution to it.

Sincerely,

DONALD W. DOUGLAS, Jr.

NORTH AMERICAN AVIATION, INC.,
OFFICE OF THE PRESIDENT,
Los Angeles, Calif., February 12, 1960.

Dr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Aeronautics,
House of Representatives, Washington, D.C.

DEAR DR. SHELDON: Receipt is acknowledged of your letter of January 21, in which you confirmed arrangements made for North American to appear before the House Committee on Science and Astronautics on February 25. You may be assured that we will cooperate to the utmost in assisting the committee in its vital work.

Mr. T. F. Dixon, chief engineer of our Rocketdyne Division, will introduce the company's presentation. Specific North American programs supporting the national space and missile effort will be covered by the following:

Mr. R. M. Ashby, chief engineer, autonetics division, autonetics.

Mr. T. F. Dixon, chief engineer, Rocketdyne Division, rocketdyne and atomics international.

Mr. W. F. Parker, chief engineer, missile division, missile.

Mr. H. A. Storms, chief engineer, Los Angeles division, Los Angeles.

We will inform you immediately if any changes in the above arrangements become necessary. Please let us know if there is any additional way we can be of service to the committee.

Sincerely yours,

J. L. ATWOOD, *President.*

When it became necessary to cancel the original appearances, the following telegram was sent to all six companies (only the addresses are eliminated):

FEBRUARY 17, 1960.

Mr. ——— ———, *President:*

Confirming call to your Washington office Chairman Brooks has delayed appearance all industry witnesses before House Science and Astronautics Committee due to changes in legislative calendar. Will propose new dates for appearances with timely notice earliest.

SHELDON, *Technical Director.*

When the chairman decided it would be impossible to hear these witnesses this year, the following letter was sent to all the companies (only the name of the addressee is eliminated):

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C., April 20, 1960.

Mr. ——— ———, *President.*

DEAR MR. ———: Chairman Brooks regrets that the pressure of time and committee obligations for handling legislation have precluded the possibility of scheduling this year the originally planned public and executive sessions with representatives of private industry as a part of the 1960 posture hearings on space and missiles. All of us had counted on these sessions as making a particularly important contribution.

In the case of some companies, it may be that the intended statements and exhibits already had been prepared at the time that it became necessary to cancel the originally scheduled appearances. We are sure that these were very fine and would be of value to the committee. If these statements, charts, and exhibits are in suitable form for publication, the committee would be pleased to receive them for inclusion in the final volume of the printed transcripts of the hearings record. If the statements are not prepared and available now, or are otherwise unsuitable for publication, we would leave open and without prejudice the decision of whether you would wish to prepare appropriate materials for receipt here by May 10, 1960, when the record will be closed for printing.

It is our hope that even though events developed this way this year, that you will grant us your forbearance, and future cooperation. We hope, of course, that the opportunity will present itself later for some of our members and staff to visit your facilities at a time mutually convenient. We also expect to undertake a major study of the long-range space program in the second half of this calendar year to which we expect your company could make a very useful contribution.

Your Washington representative has been understanding of our scheduling problems, and I assume has kept you generally posted on developments here. Thank you again for your patience.

Very sincerely,

CHARLES S. SHELDON II, *Technical Director.*

In response to this letter, the following replies were received from the companies concerned:

NORTH AMERICAN AVIATION, INC.,
OFFICE OF THE PRESIDENT,
Los Angeles, Calif., April 29, 1960.

Dr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR DR. SHELDON: You are very thoughtful to send me your letter of April 20, and you are assured always of our cooperation in your important undertakings.

It is very easy to understand the pressure of time upon your important committee and the limits imposed upon the membership and staff.

If we can be of any future service, please let us know.

Sincerely yours,

J. L. ATWOOD, *President.*

CONVAIR,
San Diego, Calif., April 29, 1960.

Mr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR MR. SHELDON: In reference to your letter of April 20, please be advised that Convair does not plan to present a prepared statement for inclusion in the transcripts of the 1960 posture hearings on space and missiles. Our preference in this regard is in no way at difference with our appreciation for the importance of the committee's activities, but results only from past uncertainty as to the timing of our participation in the hearings, and from the imminence of the May 10 closing date.

We shall be delighted to cooperate in every way with the committee's study of the long-range space program, and with any other work that the committee undertakes. In particular, we shall welcome the opportunity to receive any members of the committee or staff for an inspection of our facilities.

Sincerely,

J. V. NAISH, *President.*

DOUGLAS AIRCRAFT CO.,
OFFICE OF THE PRESIDENT,
Santa Monica, Calif., May 5, 1960.

Mr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR MR. SHELDON: Thank you for your letter of April 20 concerning the deferment of industry hearings by the House Committee on Science and Astronautics, and the deadline for material that may be submitted for the committee's printed report.

Our preparation of testimony for the committee was suspended at the time of the original postponement of our scheduled appearance, and had not progressed to the point where we would wish to offer this material for inclusion in the committee's report.

May I say, however, that we appreciate very much the committee's consideration, and your own very helpful cooperation. We stand, as always, ready to accept any opportunity to be helpful to the Congress.

Sincerely,

DONALD W. DOUGLAS, Jr.

BOEING AIRPLANE CO.,
Seattle, Wash., May 6, 1960.

Dr. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR DR. SHELDON: Please convey to Chairman Brooks our regret that committee obligations and the pressures of time precluded scheduling industry representatives for appearance in the committee's 1960 posture hearings on space and missiles.

As you suggested, we followed the proceedings of the committee so as to be alert to the principal interests of its members and in a position to prepare our statement on 1 to 2 weeks' notice. We did not, however, actually develop a prepared statement and, therefore, will not be able to take advantage of the opportunity to submit material by May 10 for inclusion in the printed transcript of the hearings record.

We are well aware of the great importance of our country's space program to national prestige, foreign policy, scientific advancement, the economy, and military security. Should the opportunity present itself at some future date, we would be pleased to contribute in support of the committee's efforts.

Sincerely,

WILLIAM M. ALLEN.

LOCKHEED AIRCRAFT CORP.,
Burbank, Calif., May 9, 1960.

DR. CHARLES S. SHELDON II,
Technical Director, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR DR. SHELDON: I want to acknowledge your invitation to present material on the status of the space program for publication as a part of the committee record.

At the time that the February hearings were canceled, preparations had not been completed and therefore no material is available. I have postponed a reply to your request in anticipation that appropriate materials related to the subject of your committee study might become available prior to your May 10 closing date. Unfortunately, this did not materialize.

In view of the above, we do not have any testimony developed along the line of your original inquiry. However, I should also like to mention my concern over the unusual hazards inherent in space programs and my concern that contractors and subcontractors be indemnified against such risks. NASA has also expressed concern over this matter and has requested authority to indemnify contractors against unusually hazardous contracts. The requested authority is the same as authority which the Department of Defense has had for several years. I strongly endorse the need for the enactment of legislation to accommodate this request of NASA as embodied in H.R. 9675.

The requested legislation, if enacted, would meet no more than the minimum needs of the Space Administration. At the same time I suggest that the committee consider broader legislation to be available in connection with nonresearch and development contracting. NASA proposed such legislation (H.R. 4148) during the 1st session of this 86th Congress which was patterned after S. 2110 which would give similar indemnity powers to the Department of Defense. Already there is need for usable authority in connection with supply as well as research and development contracts. This need will increase as work of the administration in atomic and space fields moves ahead.

Three years ago AEC was given broad powers to protect its contractors and licensees and the public against nuclear hazards. Two years ago authority was given to the Maritime Commission for use in connection with the construction of a nuclear-powered ship. Meanwhile, both NASA and DOD continue to remain lacking in adequate indemnity authority. This results in a lack of ability for the two agencies to assume proper obligations and properly protect their contractors, subcontractors, and the public when unusually hazardous tasks in atomic and proplusion work are undertaken.

Therefore, I urge not only the enactment of research and development indemnification authority, but also early consideration of usable authority in connection with supply contracts.

Certainly, we will be happy to give any assistance or information we might have in connection with your expected study of the long-range space program.

Sincerely,

COURTLANDT S. GROSS, *President.*

THE MARTIN CO.,
OFFICE OF THE PRESIDENT,
Baltimore, Md., May 10, 1960.

Hon. OVERTON BROOKS,
Chairman, Committee on Science and Astronautics,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: By letters of January 25 and April 20, 1960, Mr. Charles S. Sheldon II, technical director of your committee, has invited us to submit a statement, for inclusion in the record of the hearings recently concluded by your committee. Specifically, the letter of January 25 expresses the interest of the committee in (1) the current status of space and missile programs, (2) the NASA budget request for 1961, and (3) the President's proposals for amendment of the Space Act of 1958. As will be evident hereinafter we are vitally interested in space and missile programs and appreciate the opportunity to comment thereon.

VIKING

At the conclusion of World War II it became clear to us that missilery and exploration of space was to play an increasingly important role in world affairs. Our experience in this field dates from the end of the war at which time we began staffing highly qualified specialists and engaging in missile and space research. In 1946 we began development of Viking rockets for the Navy's upper atmosphere research program. Viking was among the first new, completely American, high-altitude vehicles built. From 1949 to 1955, 12 Vikings were launched, 11 from White Sands Proving Grounds and 1 from the U.S.S. *Norton Sound* in the Pacific. Viking No. 11 soared to 158 miles, a record for single stage unboosted rockets. The instruments on the 12 vehicles provided valuable data on conditions in the ionosphere.

ROCKET REPORT

In 1947 we completed a detailed report on a rocket vehicle designed to launch a 1,450-pound payload into orbit, and which could have been used as an intercontinental ballistic missile. This project was discontinued.

MATADOR

In 1946 we undertook development of the Matador, a ground-to-ground 500-mile-range missile. This missile has been operational and deployed since March 1954.

VANGUARD

In July of 1955, President Eisenhower announced that the United States would attempt to launch an instrumented earth satellite during the International Geophysical Year, July 1, 1957–December 31, 1958. This became Project Vanguard. We were the prime contractor responsible for design and manufacture of the vehicle to be used in placing the satellite in its orbit. The project originally was under direction of the Naval Research Laboratory, was later transferred to NASA, and has now been completed. While the original intention was to launch one satellite, as you know, three satellites were put into orbit, one of which is expected to remain in orbit 2,000 years or more.

I have given you this historical background simply to show our experience in this field, our long and intense interest, and our increasing capability to deal with the future.

At the present time we are engaged in research and development, or production, of the Pershing, the Lacrosse, the Bullpup, the GAM 83–B, the Mace and the Titan missiles.

PERSHING

The Pershing is a selective combat range artillery missile (Scram) in the development stage. The surface-to-surface missile system is designed for effective battlefield mobility and rapid reaction time. The Pershing missile is a two-stage solid propellant missile capable of deliverying a nuclear warhead and will replace the much larger Redstone missile system, when operational.

The Lacrosse missile system is a surface-to-surface system that has been developed to deliver both conventional and nuclear warheads for the close and

general support missions. As a mobile fire delivery system, it has the flexibility to keep pace with forward combat units and provide timely, lethal, and highly accurate fire on enemy forces. The first four battalions of solid-fuel Lacrosse went operational in July last year.

BULLPUP

Bullpup is a low-cost air-to-surface missile system designed for tactical use against surface targets whose relative size, importance, or disposition requires the accurate delivery of a 250-pound warhead. Bullpup is presently operational with the U.S. Navy's Atlantic and Pacific Fleets and has been performing with exceptional high reliability.

GAM 83–B

The USAF GAM 83–B weapon system is an air-to-surface missile system designed to accurately deliver a nuclear warhead by TAC aircraft. This program is a followon development of the Bullpup system and makes full use of the prior work.

MACE

The TAM–76A Mace, a surface-to-surface missile, equipped with ATRAN (map matching) guidance system, became operational with the U.S. Tactical Forces in Europe last summer, replacing the earlier Matador, previously mentioned. The new 1,200-mile-range TM–76B Mace, with inertial guidance, is now in production and recently began a series of test flights over the Atlantic missile range from Cape Canaveral. Both the A and B series Mace missiles have nuclear capabilities.

TITAN

Our biggest project at this time is development and production of the Titan. This is a two-stage, liquid-fueled, intercontinental ballistic missile designed to carry an atomic warhead. We received a letter contract in October 1955, later definitized, to design, manufacture, and test the Titan. For that purpose our Denver division was formed and through the joint efforts of the Air Force and Martin the free world's first and only completely integrated missile facility was constructed. Three years from the time ground was broken for this facility the first successful Titan flight was achieved at Cape Canaveral. This was on February 6, 1959. Other equally successful flights followed on February 25, April 3, and May 4 to establish a record-breaking series of launchings. After May 1959 the Titan fell heir to a series of mishaps such as have plagued every new missile development in the free world—and, undoubtedly, those behind the Iron Curtain as well, though we hear only of Soviet successes in this field. However, the Titan has made seven flights this year and has attained objectives that were particularly vital to the overall program. Intercontinental ranges of 5,000 miles, and nose cone separation and reentry were accomplished with three firings. The most important objective gained from this year's Titan flights was the confirmation of the soundness of the missile's two-stage design. It is this two-stage design, together with advanced structural engineering, that gives Titan its high payload capability both as a defense weapon and as a space vehicle. From the beginning the Titan has been designed for use in hardened bases and several such bases are presently under construction. The first squadron of Titans is scheduled to be operational in 1961 and we have every confidence that the schedule will be met.

DYNA-SOAR

The basic function of the Dyna-Soar program is to send an earth-launched, manned vehicle into space and back to Earth again. Rocket power will boost the vehicle to altitudes beyond the Earth's atmosphere where it could travel at speeds approaching 18,000 miles per hour. In reentering the Earth's atmosphere, the pilot will use aerodynamic controls. The craft will glide to a conventional landing area under complete control. This will be the first aerospace vehicle which combines the characteristics of missiles and aircraft into a single system. We have been working on this project since early 1958. In mid-1958 we were awarded a contract, as was another aircraft company, to perform preliminary phase I work for a period of 1 year to define a suitable development program for Dyna-Soar. This contractual effort terminated in approximately July 1959.

However, as you probably know, it was recently announced that the booster portion of Dyna-Soar would be awarded to Martin.

We feel strongly that the Dyna-Soar program is an important one to the Nation and that our previous experience has given us the qualifications and capability to properly develop the Dyna-Soar booster.

SPACE MEDICINE

Space medicine is an area of research which has been catapulted into prominence since the inception of the space age. The problem of man's survival and operational effectiveness has long been of prime concern in the design and development of aircraft, but it has assumed an even more critical role in the design and development of space systems.

For the past 2½ years the Martin Co. has included a space medicine laboratory entirely devoted to research projects directly related to the problems of man in space. While we have not solved many problems facing us in man's conquest of space, we do feel that we have helped identify some of the most critical ones.

The first problem to be solved is man's survival and our space medicine laboratory has concentrated on perfecting a lunar housing simulator which is a closed ecological system intended to provide a continuous self-sustaining human environment including food and oxygen production along with the recycling, processing, and disposal of waste materials. The objective of the development of this closed system would be to almost eliminate the staggering logistic support problem which would be present if all of man's requirements for food, water, and oxygen had to be boosted into orbit, to the Moon, or to some planetary base.

NASA BUDGET REQUEST

We do not feel that we are in a position to comment on the adequacy or inadequacy of the budget presented by NASA. We do believe, however, that the undertakings of NASA are of the utmost importance and that if the Congress approves the programs it should appropriate sufficient funds to permit them to be carried forward in a timely and orderly manner.

NATIONAL AERONAUTICS AND SPACE ACT OF 1958

It is my understanding that H.R. 9675 was originally introduced to amend the National Aeronautics and Space Act of 1958 in line with the request of the administration. We note that you now have introduced a new bill, H.R. 12049, and our comments will be directed to that bill. Among other things it would revise the congressional declaration of policy and purpose; abolish the National Aeronautics and Space Council and the Civilian Military Liaison Committee; make technical changes designed to facilitate administration of the act; and clearly delineate the jurisdiction of the National Aeronautics and Space Administration and the Department of Defense. To the extent that these amendments would facilitate administration of the act and more clearly define the respective responsibilities of the administration and the Department of Defense, we believe they represent an improvement and should receive favorable consideration of the Congress.

We are particularly interested in the proposed amendment of section 305 of the act relating to property rights in inventions. Section 305 has been the subject of much controversy and is inconsistent with provisions of law applicable to other agencies on the same subject. In almost every procurement aspect, except patents, NASA has the same legal authority and has adopted the same policies and practices as the Department of Defense in conducting its business with contractors. One of the purposes of the amendment apparently is to give NASA discretionary authority to adopt contractual patent provisions more in line with those of the Department of Defense where necessary to meet the equities of the situation. We believe this amendment, if properly administered, will go a long way toward eliminating the present unsatisfactory situation.

H.R. 12049 would add a new section 308, captioned "Indemnification." Its purpose is to give the administration authority to indemnify contractors, under certain conditions, against claims by third persons, and loss of or damage to property of the contractor, arising out of unusually hazardous risks in the performance of contracts. Indemnification has been a matter of grave concern to industry for some time. The need for indemnity clauses, in most cases, arises

from the advent of nuclear power and the use of highly volatile fuels in the missile program. The magnitude of the risks involved under procurement contracts in these areas have rendered commercial insurance either unavailable or limited in coverage. The provisions of the proposed amendment appear to be similar with those of 10 U.S.C. 2354 under which the military departments have been authorized to indemnify certain contractors since 1952. While the proposed amendment is limited to indemnification under research and development contracts, as is the referred-to authority of the military departments, we believe its enactment would be a step in the right direction.

We shall be glad to continue to cooperate with your committee and we again express our appreciation for the opportunity to submit this statement.

Very truly yours,

W. B. BERGEN.

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